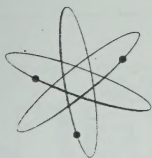


1774-77

HG-10

PRICE \$1.00

HEATHKIT® ASSEMBLY MANUAL



A M A T E U R V F O
MODEL HG-10

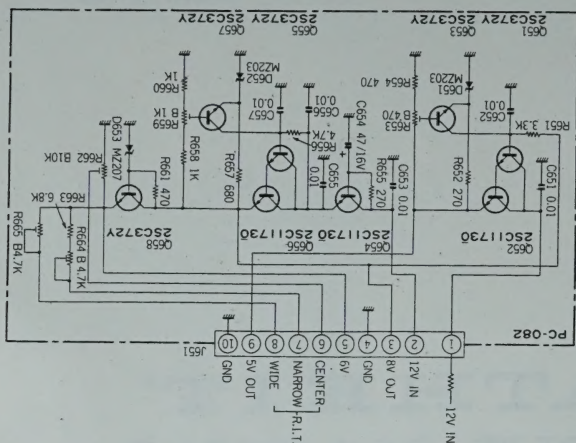


FIGURE 52. AVR Unit (PC-082) Schematic.

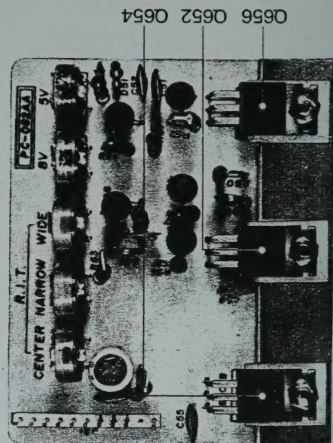


FIGURE 51. AVR Unit (PC-082) Board.

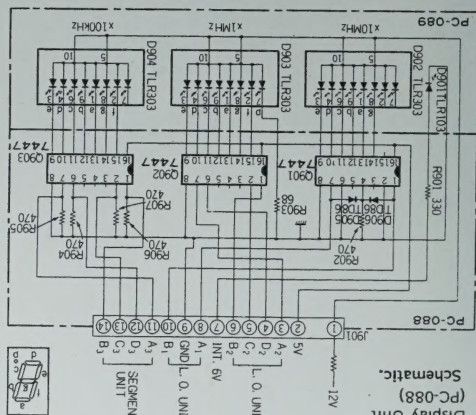


FIGURE 50.
Display Unit
(PC-088)
Schematic.

5.14 AVR UNIT (PC-082)

This circuit board holds the AVR circuit (automatic voltage regulator). The voltage outputs from the circuit are 5 VDC for the IC circuits, 8 VDC for the solid state section of the transistor, and 6 VDC for the VFO circuit. The voltage control for the RIT circuit is also included in the circuit.

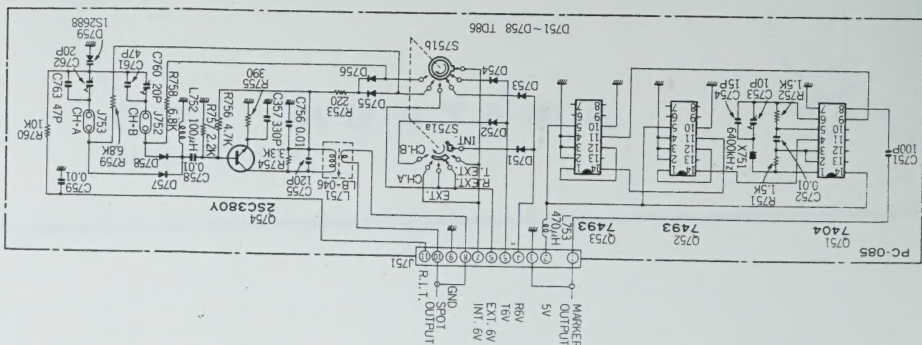
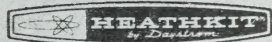


FIGURE 49. Operation Unit (PC-085) Schematic.

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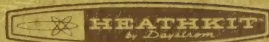
AMATEUR VFO

MODEL HG-10

WD4RVS

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HEATHKIT® ASSEMBLY MANUAL



AMATEUR VFO

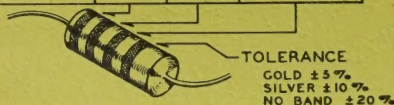
MODEL HG-10

RESISTOR AND CAPACITOR COLOR CODES

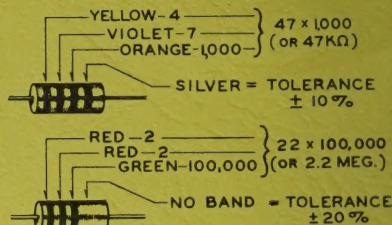
RESISTORS

The colored bands around the body of a color coded resistor represent its value in ohms. These colored bands are grouped toward one end of the resistor body. Starting with this end of the resistor, the first band represents the first digit of the resistance value; the second band represents the second digit; the third band represents the number by which the first two digits are multiplied. A fourth band of gold or silver represents a tolerance of $\pm 5\%$ or $\pm 10\%$ respectively. The absence of a fourth band indicates a tolerance of $\pm 20\%$.

COLOR	1ST DIGIT	2ND DIGIT	MULTIPLIER
BLACK	0	0	1
BROWN	1	1	10
RED	2	2	100
ORANGE	3	3	1,000
YELLOW	4	4	10,000
GREEN	5	5	100,000
BLUE	6	6	1,000,000
VIOLET	7	7	10,000,000
GRAY	8	8	100,000,000
WHITE	9	9	1,000,000,000
GOLD	-	-	.1
SILVER	-	-	.01



EXAMPLES



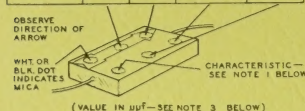
CAPACITORS

Generally, only mica and tubular ceramic capacitors, used in modern equipment, are color coded. The color codes differ somewhat among capacitor manufacturers, however the codes

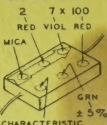
shown below apply to practically all of the mica and tubular ceramic capacitors that are in common use. These codes comply with EIA (Electronics Industries Association) Standards

MICA

COLOR	1st DIGIT	2nd DIGIT	MULTIPLIER	TOLER. %
BLACK	0	0	1	±20
BROWN	1	1	10	±20
RED	2	2	100	±20
ORANGE	3	3	1,000	±20
YELLOW	4	4	10,000	±20
GREEN	5	5	100,000	±20
BLUE	6	6	1,000,000	±20
VIOLET	7	7	10,000,000	±20
GRAY	8	8	100,000,000	±20
WHITE	9	9	1,000,000,000	±20
GOLD	-	-	.1	±10
SILVER	-	-	.01	±10



EXAMPLE



2700 puf ±5 %
OR 0027 ufd

TUBULAR CERAMIC

Place the group of rings or dots to the left and read from left to right.

COLOR	1st DIGIT	2nd DIGIT	MULTIPLIER	TOLER. %
BLACK	0	0	1	±20
BROWN	1	1	10	±20
RED	2	2	100	±20
ORANGE	3	3	1,000	±20
YELLOW	4	4	10,000	±20
GREEN	5	5	100,000	±20
BLUE	6	6	1,000,000	±20
VIOLET	7	7	10,000,000	±20
GRAY	8	8	100,000,000	±20
WHITE	9	9	1,000,000,000	±20



EXAMPLE



NOTES:

1. The characteristic of a mica capacitor is the temperature coefficient, drift capacitance and insulation resistance. This information is not usually needed to identify a capacitor but, if desired, it can be obtained by referring to EIA Standard, RS-153 (a Standard of Electronic Industries Association.)

2. The temperature coefficient of a capacitor is the predictable change in capacitance with temperature change and is

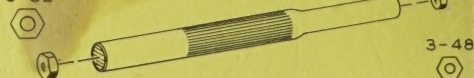
expressed in parts per million per degree centigrade. Refer to EIA Standard, RS-198 (a Standard of Electronic Industries Association.)

3. The farad is the basic unit of capacitance, however capacitor values are generally expressed in terms of puf (microfarad, .000001 farad) and uuf (micro-micro-farad, .0000001 farad); therefore, 1,000 uuf = .001 puf, 1,000,000 uuf = 1 puf

USING A PLASTIC NUT STARTER

A plastic nut starter offers a convenient method of starting the most used sizes: 3/16" and 1/4" (3-48 and 6-32). When the correct end is pushed down over a nut, the pliable tool conforms to the shape of the nut and the nut is gently held while it is being picked up and started on the screw. The tool should only be used to start the nut.

6-32



3-48

SPECIFICATIONS

Band Coverage.	Band (Meters)	Dial Calibration (mc)	Output Frequency (mc)
	80	3.5 to 4	3.5 to 4
	40	7 to 7.4	7 to 7.425
	20	14 to 14.8	7 to 7.425
	15	21 to 22.2	7 to 7.425
	10	28 to 29.7	7 to 7.425
	6	50 to 54	8.333 to 9
	2	144 to 148	8 to 8.222
Load Impedance.	50,000 Ω or more.		
Output Voltage.	5 volts rms, open circuit.		
Output Connector.	Phono-type socket.		
Controls.	FUNCTION switch (STBY-OPR-SPOT). FREQUENCY (variable capacitor). BAND switch.		
Tube Complement.	1 - 6CH8, Oscillator-Cathode follower. 1 - OB2, Voltage regulator.		
Power Requirements.	108 volts DC at 25 milliamperes and 6.3 volts AC or DC at 0.75 ampere. (These voltages are provided directly from the accessory socket of the HEATHKIT DX-60 and DX-40 Transmitters; a minor circuit change in the VFO is required for the DX-40.)		
Dimensions.	9-3/8" wide x 6-1/2" high x 9-1/8" deep.		
Net Weight.	9-1/2 lbs.		
Shipping Weight.	12 lbs.		

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VOLTAGE REGULATOR

Voltage for the plates and screen grid of tube V1 is applied through series dropping resistor R11 to voltage regulator (VR) tube V2. The characteristics of this tube are such that the current through it will vary to maintain a constant voltage drop across the tube. The DC voltage at the plate of the VR tube, therefore, remains constant, regardless of fluctuations in the applied B+ voltage. Regulated DC voltage from V2 is applied as B+ to V1A and V1B. The use of regulated B+ voltage is essential to the stable operation of oscillator stage V1A. Resistor R11 must be changed in value to compensate for different values of applied B+ voltage. This change is covered under Installation, with Figure 2 to obtain correct values.

Filament, B+, and grid block keying voltages for the VFO are obtained through the 4-conductor power cable from the associated transmitter. The fourth wire of the power cable is a ground connection between the VFO and transmitter ground circuits.

KEYING

For grid block keying, a keyed, negative DC voltage is applied from the transmitter, through the VFO power cable, to the neon lamp in the VFO. This DC voltage causes the neon lamp to conduct, allowing the negative voltage to be applied through R8 and R10 to the control grid of oscillator tube V1A. As a result, this keyed negative voltage turns the oscillator off and on. NOTE: The HEATHKIT DX-60 Transmitter provides the necessary grid block keying voltage for the VFO.

For cathode keying, it may be necessary to remove the jumper wire from across the key jack of the VFO and to make the keying connection from the transmitter to the VFO power cable. These two circuit changes are shown on the

Schematic Diagram and will be described in the Installation section of the manual. When the key used with the transmitter is closed, a low-resistance ground path is provided for the cathode of oscillator stage V1A in the VFO. This ground path is through RFC2, R2, the FUNCTION switch, the key connection of the power cable, and finally through the closed key. As just described, closing the key provides a low-resistance ground path for the cathode of V1A, turning the oscillator on. With the key open, the cathode ground path is through resistor R9. The value of R9 represents a high-impedance ground path, preventing the oscillator from operating.

FUNCTION SWITCH

This switch has three positions which provide the following functions:

STBY (Standby): In this position, the cathode of the oscillator tube is not connected to ground through a low-resistance path and the oscillator is not operating.

OPR (Operate): With the VFO wired for grid block keying, the OPR position of the FUNCTION switch provides a low-resistance ground path for the cathode of the oscillator tube, turning on the oscillator. Grid block keying voltage is applied to the grid of the oscillator tube.

With the VFO wired for cathode keying, the cathode of the oscillator tube is connected to the key jack of the transmitter for keying, and the grid block keying circuit is disconnected and not used.

SPOT: The SPOT position of the FUNCTION switch connects the cathode of the oscillator tube to ground and opens the grid block keying circuit, turning on the oscillator, regardless of whether the VFO is wired for grid block or cathode keying.

CONSTRUCTION NOTES

This manual is supplied to assist you in every way to complete your kit with the least possible chance for error. The arrangement shown is the result of extensive experimentation and trial. If followed carefully, the result will be a stable instrument, operating with a high degree of dependability. We suggest that you retain the manual in your files for future reference, both in the use of the instrument and for its maintenance.

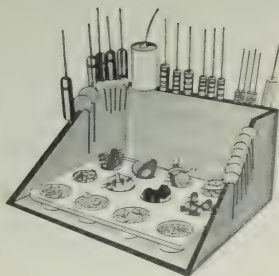
UNPACK THE KIT CAREFULLY AND CHECK EACH PART AGAINST THE PARTS LIST. In so doing, you will become acquainted with the parts. Refer to the charts and other information on the inside covers of the manual to help you identify the components. If some shortage or parts damage is found in checking the Parts List, please read the Replacement section and supply the information called for therein. Include all inspection slips in your letter to us.

Resistors generally have a tolerance rating of 10% unless otherwise stated in the Parts List. Tolerances on capacitors are generally even greater. Limits of +100% and -20% are common for electrolytic capacitors.

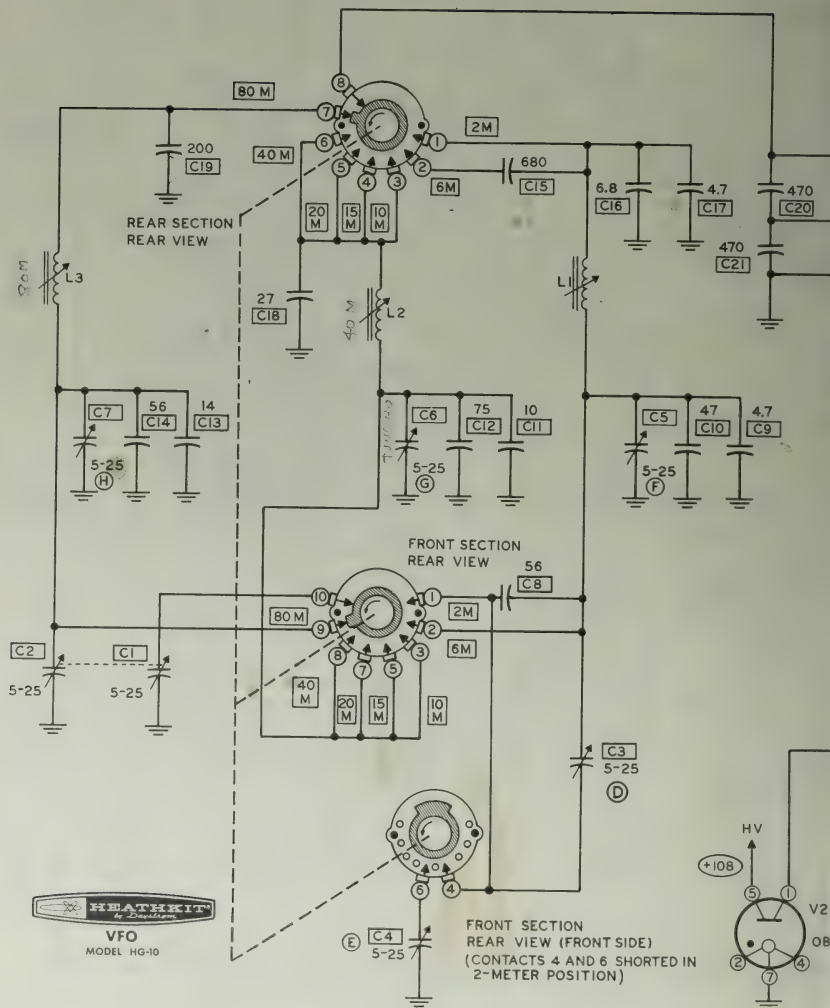
We suggest that you do the following before work is started:

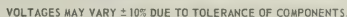
1. Lay out all parts so that they are readily available.
2. Provide yourself with good quality tools. Basic tool requirements consist of a screwdriver with a 1/4" blade; a small screwdriver with a 1/8" blade; long-nose pliers; wire cutters, preferably separate diagonal cutters; a pen knife or a tool for stripping insulation from wires; a soldering iron (or gun) and rosin core solder. A set of nut drivers and a nut starter, while not necessary, will aid extensively in construction of the kit.

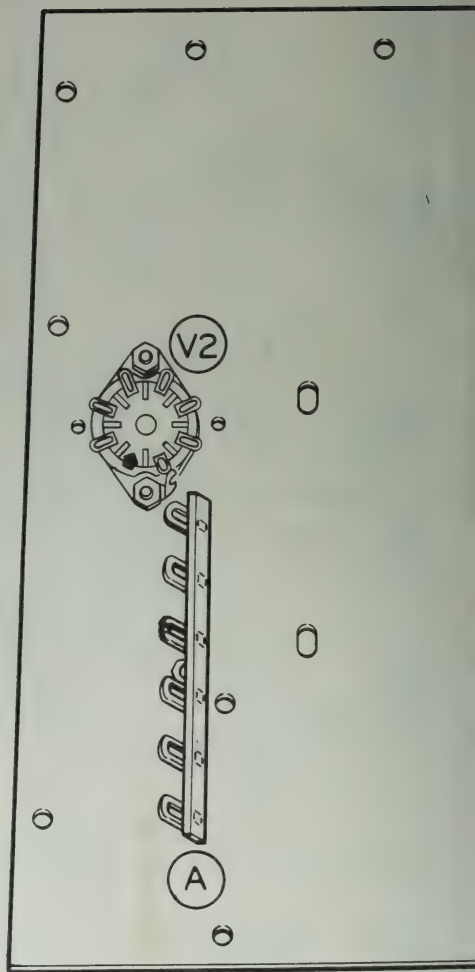
Most kit builders find it helpful to separate the various parts into convenient categories. Muffin tins or molded egg cartons make convenient trays for small parts. Resistors and capacitors may be placed with their lead ends inserted in the edge of a piece of corrugated cardboard until they are needed. Values can be written on the cardboard next to each component. The illustration shows one method that may be used.



BAND SWITCH



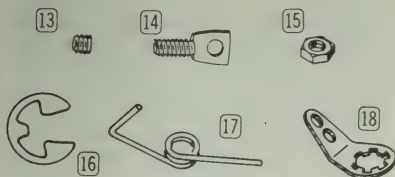




PART PARTS DESCRIPTION
No. Per Kit

Hardware (cont'd)

13	250-33	2	6-32 x 1/8" setscrew
	250-43	4	8-32 x 1/4" setscrew, slotted head
14	251-1	2	6-32 spade bolt
15	252-1	16	3-48 nut
	252-40	3	5-40 nut
	252-3	48	6-32 nut
	252-7	11	Control nut
	253-10	5	Control flat washer
16	253-11	1	E washer
	253-36	2	Spring washer
	253-39	1	9/16" OD flat washer
	253-42	4	1/2" OD flat washer
	254-7	19	#3 lockwasher
	254-1	62	#6 lockwasher
	254-4	9	Control lockwasher
	255-13	1	1/4" spacer
	255-16	2	1-1/4" spacer (shouldered)
	255-17	4	1/2" spacer (shouldered)
	258-1	2	Dial cord spring
17	258-25	1	Gear tension spring
18	259-1	2	Large #6 solder lug
	259-6	1	Small #6 solder lug
	259-10	1	3/8" control solder lug
	259-12	3	1/4" solder lug



Terminal Strips-Sockets-Plugs

431-46	1	2-lug terminal strip
431-10	1	3-lug terminal strip
431-45	1	6-lug terminal strip
431-49	1	11-lug terminal strip
434-34	1	7-pin tube socket
434-75	1	9-pin tube socket
434-42	1	Phono socket
434-88	2	Pilot lamp socket
436-4	1	Phone jack (Key)
438-4	2	Phono plug
438-6	1	Octal plug
440-1	1	Octal plug cap

PART PARTS DESCRIPTION
No. Per Kit

Wire

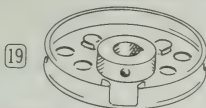
340-2	1	Length #20 bare wire (small)
340-3	1	Length #16 bare wire (heavy)
343-5	1	Length coax cable (RG-62/U)
344-1	1	Length hookup wire
347-7	1	Length 4-conductor cable

Metal Parts

90-M179F	1	Cabinet
203-M255F526-527		
	1	Front panel
203-M254	1	Subpanel
205-M312F525		
	1	Chassis
201-M29F524		
	1	Chassis base
205-M313	1	Bottom plate
205-M314	1	Gear mounting plate
205-M315F	1	Dial plate
204-135	1	Angle bracket (small)
204-M213	1	Angle bracket (pointed)
204-M215	1	Dial pointer bracket (channel shaped)
204-M423	1	Variable capacitor bracket

Assemblies

100-M19	1	Dial cord drum, small
100-M165	1	Dial cord drum, large
100-M125	1	Dial cylinder plug with bushing
100-M132	2	Dial cylinder support with two pulleys
100-M200	1	Dial cylinder shaft with pulley attached
100-201	1	Shaft with small gear
100-202	1	Shaft with large gear



Gears-Shafts-Bushing-Coupling-Pulley

451-12	1	Nylon gear
451-15	1	Brass gear
451-16	1	Anti-backlash gear
453-35	1	4-3/8" shaft
453-78	1	1-1/2" shaft
455-6	7	Shaft bushing
456-7	1	Shaft coupling
466-7	1	Dial pulley (small)

PART No.	PARTS Per Kit	DESCRIPTION
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Miscellaneous

73-4	2	Rubber grommet
75-30	1	Plastic strain relief
261-9	4	Rubber feet
349-1	1	Length dial cord
446-29	1	Dial window
462-121	1	Large knob

PART No.	PARTS Per Kit	DESCRIPTION
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Miscellaneous (cont'd)

462-122	2	Small knob
463-15	1	Dial pointer
464-19	1	Dial cylinder (plastic)
485-M7	1	Dial cylinder plug (1/4" center hole)
331-6		Solder
595-452	1	Manual

PROPER SOLDERING TECHNIQUES

Only a small percentage of HEATHKIT equipment purchasers find it necessary to return an instrument for factory service. Of these instruments, by far the largest portion of malfunctions are due to poor or improper soldering.

If terminals are bright and clean and free of wax, frayed insulation and other foreign substances, no difficulty will be experienced in soldering. Correctly soldered connections are essential if the performance engineered into a kit is to be fully realized. If you are a beginner with no experience in soldering, a half hour's practice with some odd lengths of wire may be a worthwhile investment.

For most wiring, a 30 to 100 watt iron or its equivalent in a soldering gun is very satisfactory. A lower wattage iron than this may not heat the connection enough to flow the solder smoothly over the joint. Keep the iron tip clean and bright by wiping it from time to time with a cloth.

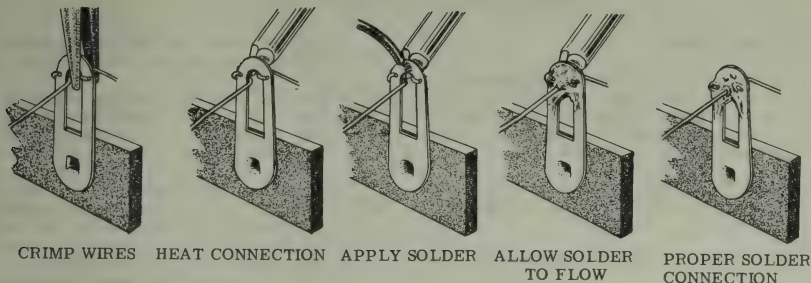
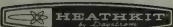
CHASSIS WIRING AND SOLDERING

1. All wire used, except the heavy bare wire, is the type with colored insulation (hookup wire). In preparing a length of hookup wire, 1/4" of insulation should be removed from each end unless directed otherwise in the construction step.
2. Leads on resistors, capacitors and similar components are generally much longer than they need to be to make the required connections. In these cases, the leads should be cut to proper length before the part is added to the chassis. In general, the leads should

be just long enough to reach their terminating points.

3. Crimp or bend the wire around the terminal just enough to hold it in place until it is soldered. Do not knot or twist the wire around the lug. For the heavy bare wire, position the wire so that a good solder connection can be made.
4. Position the work, if possible, so that gravity will help to keep the solder where you want it.
5. Place a flat side of the soldering iron tip against the joint to be soldered until it is heated sufficiently to melt the solder.
6. Then place the solder against the heated terminal and it will immediately flow over the joint; use only enough solder to thoroughly wet the junction. It is usually not necessary to fill the entire hole in the terminal with solder.
7. Remove the solder and then the iron from the completed junction. Use care not to move the leads until the solder is solidified.

A poor or cold solder joint will usually look crystalline and have a grainy texture, or the solder will stand up in a blob and will not have adhered to the joint. Such joints should be reheated until the solder flows smoothly over the entire junction. In some cases, it may be necessary to add a little more solder to achieve a smooth bright appearance.



NOTE: ALL GUARANTEES ARE VOIDED AND WE WILL NOT REPAIR OR SERVICE INSTRUMENTS IN WHICH ACID CORE SOLDER OR PASTE FLUXES HAVE BEEN USED. WHEN IN DOUBT ABOUT SOLDER, IT IS RECOMMENDED THAT A NEW ROLL PLAINLY MARKED "ROSIN CORE RADIO SOLDER" BE PURCHASED.

STEP-BY-STEP PROCEDURE

The following instructions are presented in a logical step-by-step sequence to enable you to complete your kit with the least possible confusion. Be sure to read each step all the way through before beginning the specified operation. Also read several steps ahead of the actual step being performed. This will familiarize you with the relationship of the subsequent operations. When the step is completed, check it off in the space provided. This is particularly important as it may prevent errors or omissions, especially if your work is interrupted. Some kit builders have also found it helpful to mark each lead in colored pencil on the Pictorial as it is added.

The fold-out diagrams in this manual may be removed and attached to the wall above your working area; but, because they are an integral part of the instructions, they should be returned to the manual after the kit is completed.

In general, the illustrations in this manual correspond to the actual configuration of the kit; however, in some instances the illustrations

may be slightly distorted to facilitate clearly showing all of the parts.

The abbreviation "NS" indicates that a connection should not be soldered yet as other wires will be added. When the last wire is installed, the terminal should be soldered and the abbreviation "S" is used to indicate this. Note that a number will appear after each solder instruction. This number indicates the number of leads that are supposed to be connected to the terminal in point before it is soldered. For example, if the instruction reads, "Connect a lead to lug 1 (S-2)," it will be understood that there will be two leads connected to the terminal at the time it is soldered. (In cases where a lead passes through a terminal or lug and then connects to another point, it will count as two leads, one entering and one leaving the terminal.)

The steps directing the installation of resistors include color codes to help identify the parts. Also, if a part is identified by a letter-number designation on the Schematic, its designation will appear at the beginning of the construction step which directs its installation.

STEP-BY-STEP ASSEMBLY

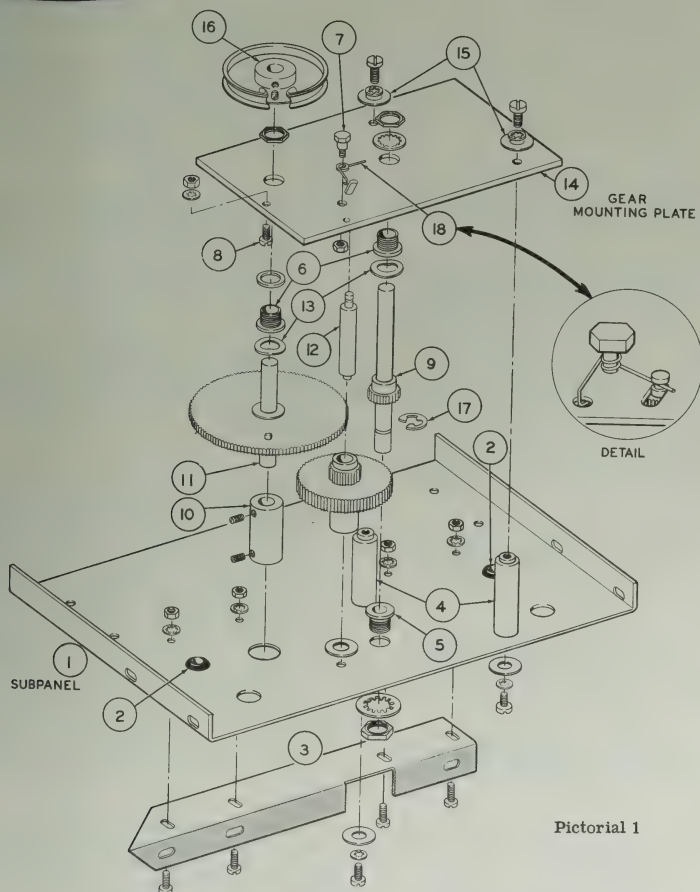
DIAL MECHANISM

All of the parts used in the dial mechanism are shown on Pictorials 1 and 2. The following steps are keyed to the pictorials by circled numbers. Follow the steps carefully and refer to Pictorials 1 and 2 as each part is installed.

- ① (✓) Position the subpanel as shown, using the holes in the subpanel as a guide for correct orientation.
- ② (✓) Install the two rubber grommets in the subpanel.
- ③ (✓) Mount the pointed angle bracket to the subpanel with four 6-32 x 3/8" screws, #6 lockwashers, and 6-32 nuts. Be sure the pointed end of this bracket is placed as shown. Do not tighten the screws yet.
- ④ (✓) Locate the two 1-1/4" shouldered spacers. Secure one end of each spacer at the correct point on the subpanel as indicated in Pictorial 1. Use 6-32 x 1/4" screws, #6 lockwashers, and 1/2" OD flat washers.
- ⑤ (✓) Mount a shaft bushing on the subpanel. Use a control lockwasher and control nut.
- ⑥ (✓) Mount two shaft bushings on the gear mounting plate. Be sure to use control washers and control nuts as shown in Pictorial 1.
- ⑦ (✓) Place the 5-40 x 5/16" hex head screw through the gear tension spring. Secure this screw and spring to the gear mounting plate as shown, using a 5-40 nut. The bent end of the spring should fit into the small hole of the plate. Bend this end of the spring over so it will not pull back through the plate.
- ⑧ (✓) Place the 6-32 x 3/16" screw through the gear mounting plate and fasten it with a #6 lockwasher and 6-32 nut as shown.
- ⑨ (✓) Locate the gear shaft assembly with the small brass gear (#100-201, in the small cardboard box). Insert the

shorter shaft end of this assembly through the bushing in the subpanel.

- ⑩ (✓) Locate the shaft coupling and start two 6-32 x 1/8" setscrews into it. Be careful to get the screws started straight.
- ⑪ (✓) Place the shaft coupling over the longer end of the remaining gear-shaft assembly (#100-202). Position the end of the shaft half way into the coupling and tighten the setscrew. Place the coupling through the large hole in the subpanel.
- ⑫ (✓) Place the 1-1/2" shaft through the nylon gear. The shaft ends are different, and should be placed as shown on Pictorial 1. Place a 9/16" OD flat washer over the lower shaft end, then insert this end of the shaft into the correct hole of the subpanel as shown in Pictorial 1. The nylon gear mounts below the large gear of step 11, as shown.
- ⑬ (✓) Place spring washers over the shafts of the two gear-shaft assemblies.
- ⑭ (✓) Set the gear mounting plate over the shafts and spacers extending up from the subpanel. The shafts of the gear-shaft assemblies should fit through the two shaft bushings in the plate, and the shoulders of the two spacers should fit into the correct two holes of the plate. The nylon gear should mesh with the two adjacent gears.
- ⑮ (✓) Fasten the gear mounting plate in place with 6-32 x 1/4" screws, #6 lockwashers, and 1/2" OD flat washers; place the screws into the ends of the spacers.
- ⑯ (✓) Start an 8-32 x 1/4" slotted setscrew into the bushing of the larger dial cord drum. Place this dial cord drum over the end of the shaft with the large gear. Position the drum so that the spring washer between the gear and gear mounting plate is slightly compressed. The dial cord exit in the side



Pictorial 1

of the drum should be placed in the same angular position as the stop pin of the large gear. Now tighten the set-screw.

- 17 (✓) Install the E washer in the groove in the shaft of the other gear-shaft assembly. The spring washer above the gear

on this shaft should now be slightly compressed.

- 18 (✓) Place the straight end of the gear tension spring against the notch in the end of the nylon gear shaft. This will hold the nylon gear in mesh with the other two gears.

Refer to Pictorial 2 for the following steps.

(19) (✓) Mount the two pilot lamp sockets on the subpanel. Use a 6-32 x 3/8" screw, two #6 lockwashers, a #6 solder lug, and a 6-32 nut. Position the solder lug as shown before tightening.

(20) (✓) Install a shaft bushing in each of the two dial cylinder supports. Use control lockwashers and control nuts as shown in the Detail on Pictorial 2.

NOTE: In the following steps, it is important to position the plastic dial cylinder so that its numbering will be right side up. Study the numbering on the cylinder before proceeding.

(21) (✓) Insert the dial cylinder plug with the bushing attached to it (#100-M125) into the end of the dial cylinder with the lowest frequency numbering. Start a 6-32 x 1/4" screw into the bushing. Line this screw up with the 6 Meter scale.

(22) (✓) Insert the dial cylinder plug with the 1/4" center hole into the other end of the dial cylinder.

(23) (✓) Place the dial cylinder shaft through the dial drum plugs. Insert it from the end with the highest frequency numbering.

(24) (✓) Place the two dial cylinder supports at the ends of the dial cylinder just assembled. The shaft extending from each end should fit into the bushings of the supports.

(25) (✓) Mount the dial cylinder supports and dial cylinder to the subpanel, using 6-32 x 3/8" screws, #6 lockwashers, and 6-32 nuts.

(26) (✓) Push the dial cylinder bushing of the dial drum plug against the dial drum support. Be sure there is no excessive lateral movement and that the dial indicator turns smoothly. Then tighten the screw in the bushing of the dial drum plug.

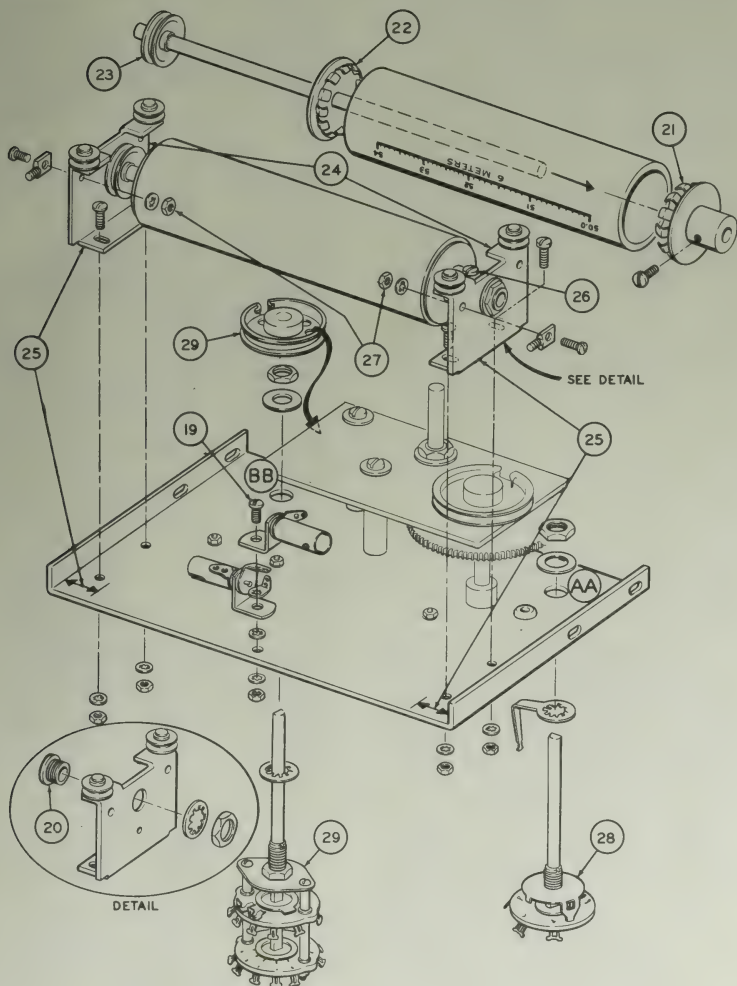
(27) (✓) Mount a 6-32 spade bolt on each of the dial cylinder supports. Use 6-32 x 1/4" screws, #6 lockwashers, and 6-32 nuts. Make sure the offset shoulder of each spade bolt fits over the edge of the dial cylinder support as indicated in Pictorial 2. Be sure to use the correct mounting hole in each support.

(28) (✓) Mount the 1-section rotary switch (#63-282) on the subpanel, using a control solder lug, control flat washer, and control nut. Refer forward to Pictorial 5 (fold-out from Page 21) for positioning of this switch and the solder lug (location AA).

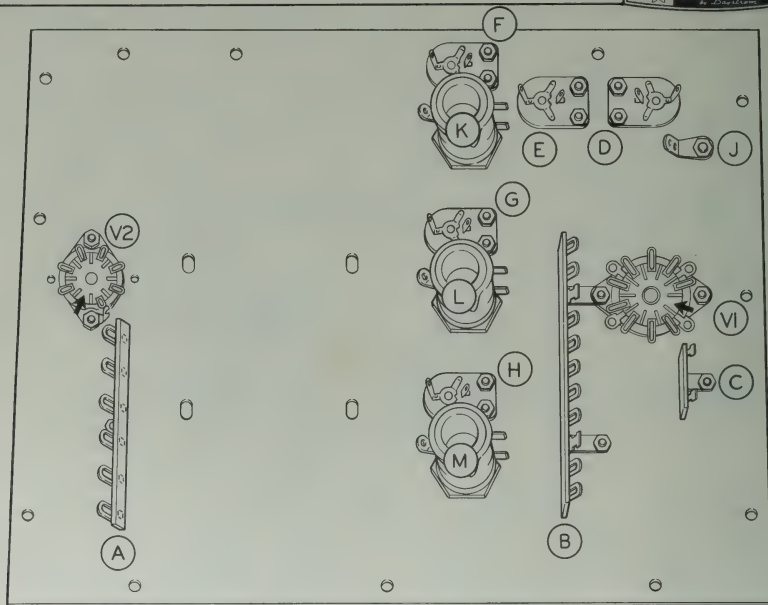
NOTE: In the next step, the dial cord drum will not fit onto the switch shaft after the switch is mounted. To avoid difficulty, study the switch mounting sequence in Pictorial 2 before performing step 29.

(29) () Insert an 8-32 x 1/4" slotted setscrew in the bushing of the small dial cord drum. Mount the remaining rotary switch (#63-280) on the subpanel and mount the small dial cord drum on the shaft just below the gear mounting plate. Use a control lockwasher, control flat washer, and control nut to mount the switch. Refer forward to Pictorial 5 for positioning of this switch (location BB). Turn the switch shaft fully counterclockwise, and set the dial cord drum so its opening is aimed at the closest corner of subpanel as shown in Pictorial 2, and tighten the setscrew so the drum is about 5/8" from the subpanel.

This completes assembly of the dial mechanism. See that all shafts turn freely, with no binding. A drop of light oil should be applied to each of the shaft bushings. Also make sure that the dial cylinder is parallel to the edge of the subpanel. Now set the dial mechanism aside until it is called for later.



Pictorial 2

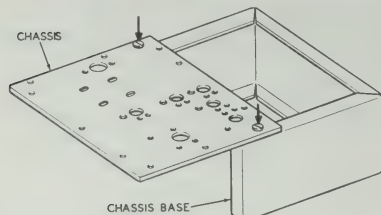


Pictorial 3

CHASSIS PARTS MOUNTING

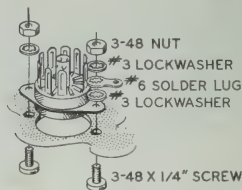
Refer to Pictorial 3 for the following steps.

(1) Orient the chassis as shown in Pictorial 3, lettered side down, then temporarily attach it to the chassis base as shown in Detail 3A. Use two 6-32 x 1/4" screws and 6-32 nuts. The chassis base will serve as a fixture to hold the chassis up during the parts mounting and initial wiring operations.



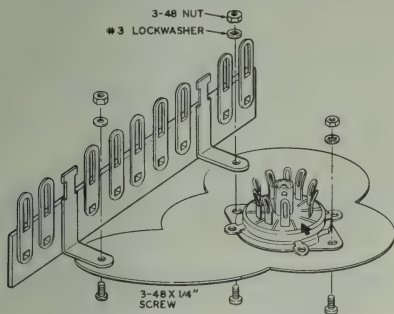
Detail 3A

(✓) Mount the 7-pin tube socket at V2. Use 3-48 x 1/4" screws, #3 lockwashers, a small #6 solder lug, and 3-48 nuts as shown in Detail 3B. Make sure the blank space of the socket is positioned as indicated by the arrow in Pictorial 3.



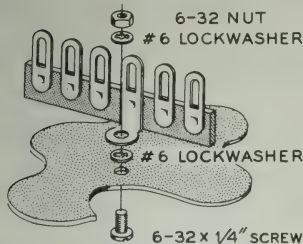
Detail 3B

- (✓) Mount the 9-pin tube socket at V1 along with 11-lug terminal strip B. Use 3-48 x 1/4" screws, #3 lockwashers, and 3-48 nuts as shown in Detail 3C. See that the blank space of the tube socket is positioned as indicated by the arrow in Pictorial 3.



Detail 3C

- (✓) Mount 6-lug terminal strip A. Use a 6-32 x 1/4" screw, #6 lockwashers, and a 6-32 nut as shown in Detail 3D.



Detail 3D

- (✓) In a similar manner, mount 2-lug terminal strip C, using a 3-48 x 1/4" screw, #3 lockwashers, and a 3-48 nut.

- (✓) C3. Mount trimmer capacitor D with 3-48 x 1/4" screws, #3 lockwashers, and 3-48 nuts. Position the trimmer as shown in Pictorial 3 and then place the screws up through the chassis and trimmer. Fasten the screws with lockwashers and nuts.

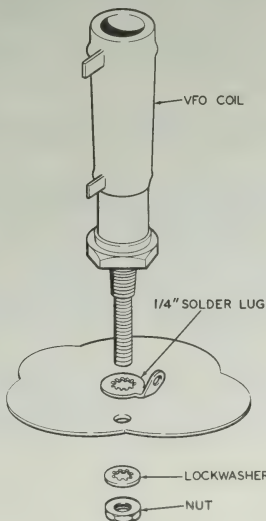
Check to see that the rotating part of the trimmer turns freely.

- (✓) C4, C5, C6, C7. In the same way, mount trimmer capacitors E (C4), F (C5), G (C6), and H (C7).

- (✓) Using a 6-32 x 1/4" screw and a 6-32 nut, mount a #6 solder lug at J.

- (✓) L1, L2. Locate the two identical VFO coils (#40-329). Mount these coils at K and L. Use the nut and lockwasher furnished with each coil plus a 1/4" solder lug. Refer to Detail 3E which shows the mounting procedure. Place the coil lugs and solder lugs of each coil as shown in Pictorial 3.

- (✓) L3. Mount the 80-meter coil (#40-381) at M. Use the nut and lockwasher furnished with the coil, plus a 1/4" solder lug as for the previous coils.

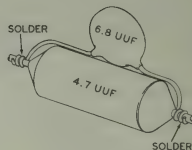


Detail 3E

CHASSIS WIRING

Refer to Pictorial 4 (fold-out from Page 6) for the following steps.

NOTE: Hookup wire should be used in the wiring steps associated with Pictorial 4. When bare wire is called for, use the #20 (small) bare wire. The heavy bare wire should not be used until it is specifically called for in a later section.



Detail 4A

- (✓) Connect one end of a 1-1/2" bare wire to lug 2 of trimmer D (S-1). Leave the other end free.
- (✓) Connect one end of a 1-1/2" bare wire to lug 1 of trimmer D (S-1). Leave the other end free.
- (✓) Connect one end of a 1-1/2" bare wire to lug 2 of trimmer E (S-1). Leave the other end free.
- (✓) Connect a 2" bare wire from lug 1 of trimmer F (NS), through ground lug 3 of coil K (NS), to lug 1 of trimmer E (S-1). Now solder ground lug 3 of coil K (S-2).

NOTE: When installing capacitors and resistors, cut the leads just long enough to make the proper connections with the parts placed as shown in Pictorial 4.

- * In the steps indicated with an asterisk (*), cut the component leads to 3/8" before wiring in the part.
- *(✓) C9. Connect a 4.7 μf tubular ceramic capacitor between lugs 1 (NS) and 2 (NS) of trimmer F.
- (✓) Connect a bare wire from lug 2 of trimmer F (NS) to lug 2 of coil K (NS).
- *(✓) C10. Connect a 47 μf disc ceramic capacitor between lugs 1 (NS) and 2 (S-3) of trimmer F.
- () C16, C17. Prepare a 6.8 μf disc ceramic capacitor and 4.7 μf tubular ceramic capacitor combination as shown in Detail 4A. Connect this combination from lug 1 of trimmer F (S-4) to lug 1 of coil K (NS).

- (✓) Connect a bare wire from lug 1 of trimmer G (NS) to ground lug 3 of coil L (S-1).

- *(✓) C11. Connect a 10 μf tubular ceramic capacitor between lugs 1 (NS) and 2 (NS) of trimmer G.

- *(✓) C12. Connect a 75 μf disc ceramic capacitor between lugs 1 (NS) and 2 (NS) of trimmer G.

- (✓) Connect a bare wire from lug 2 of trimmer G (S-3) to lug 2 of coil L (NS).

- (✓) C18. Connect a 27 μf disc ceramic capacitor from lug 1 of trimmer G (S-4) to lug 1 of coil L (NS).

- (✓) Connect a bare wire from lug 1 of trimmer H (NS) to ground lug 3 of coil M (S-1).

- *(✓) C14. Connect a 56 μf disc ceramic capacitor between lugs 1 (NS) and 2 (NS) of trimmer H.

- *(✓) C13. Connect a 14 μf tubular ceramic capacitor between lugs 1 (NS) and 2 (NS) of trimmer H.

- (✓) Connect a bare wire from lug 2 of trimmer H (S-3) to lug 2 of coil M (NS).

(✓) C19. Connect a 200 μf mica capacitor from lug 1 of trimmer H (S-4) to lug 1 of coil M (NS).

(✓) Connect a 2-1/2" hookup wire between lugs 4 (NS) and 11 (NS) of terminal strip B.

NOTE: All resistors shown on Pictorial 4 are 1/2 watt.

(✓) R9. Connect a 22 $\text{K}\Omega$ (red-red-orange) resistor between lugs 1 (NS) and 3 (NS) of terminal strip B.

(✓) R10. Connect a 47 $\text{K}\Omega$ (yellow-violet-orange) resistor between lugs 1 (NS) and 4 (S-2) of terminal strip B.

(✓) C32. Connect a .001 μfd disc ceramic capacitor between lugs 1 (NS) and 3 (S-2) of terminal strip B.

(✓) Connect a bare wire from lug 6 (NS), through lug 7 (NS), to lug 8 (NS) of terminal strip B.

(✓) R2. Connect an 82 Ω (gray-red-black) resistor between lugs 5 (NS) and 10 (NS) of terminal strip B.

(✓) C26. Connect a .005 μfd disc ceramic capacitor between lugs 9 (NS) and 10 (NS) of terminal strip B.

(✓) C28. Connect a .005 μfd disc ceramic capacitor between lugs 7 (NS) and 9 (NS) of terminal strip B.

(✓) R7. Connect a 10 $\text{K}\Omega$ (brown-black-orange) resistor between lugs 9 (S-3) and 10 (NS) of terminal strip B.

(✓) RFC1. Connect the 28 microhenry RF choke from lug 8 of terminal strip B (NS) to lug 2 of terminal strip C (NS).

(✓) C24. Connect a .005 μfd disc ceramic capacitor from lug 3 of tube socket V1 (NS) to the ground lug of this socket near lug 3 (S-1).

(✓) R1. Connect a 10 $\text{K}\Omega$ (brown-black-orange) resistor from lug 7 of terminal strip B (S-4) to lug 3 of tube socket V1 (S-2).

(✓) R4. Connect a 1000 Ω (brown-black-red) resistor from lug 6 of terminal strip B (S-2) to lug 1 of terminal strip C (NS).

(✓) Connect a 1-1/4" hookup wire from lug 2 of tube socket V1 (NS) to lug 2 of terminal strip C (S-2).

(✓) Connect a 1-1/4" hookup wire from lug 9 of tube socket V1 (NS) to lug 1 of terminal strip C (NS).

(✓) C29. Connect a .005 μfd disc ceramic capacitor from lug 9 of tube socket V1 (S-2) to the ground lug of this socket near lug 1 (S-1). Dress this capacitor to avoid the area near the edge of the chassis where the chassis base will be mounted later.

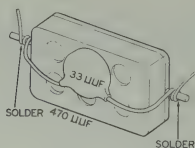
(✓) Connect one end of a 1-1/2" bare wire to lug 1 of tube socket V1 (S-1). Leave the other end free.

(✓) R3. Connect a 150 $\text{K}\Omega$ (brown-green-yellow) resistor from lug 1 of terminal strip C (S-3) to lug 8 of tube socket V1 (NS).

(✓) Connect a bare wire from the center post (NS), through lug 5 (NS), to the socket ground lug near lug 6 (NS) of tube socket V1. Now solder lug 5 (S-2) and the center post (S-1).

* (✓) C25. Connect a .005 μfd disc ceramic capacitor from lug 4 of tube socket V1 (NS) to the ground lug of this socket near lug 6 (S-2).

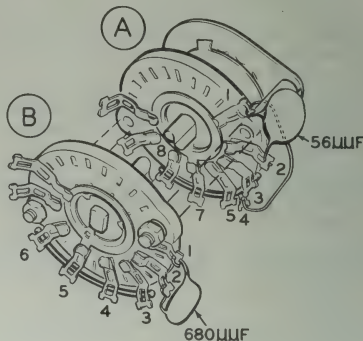
- (✓) C21, C23. Prepare a 470 μf molded mica capacitor and a 33 μf disc ceramic capacitor combination, as shown in Detail 4B.



Detail 4B

- (✓) Connect this combination from lug 6 of tube socket V1 (NS) to ground lug J (S-1). Leave room for the other capacitor combination shown in Pictorial 4.
- (✓) C20, C22. Prepare another 470 μf molded mica capacitor and 33 μf disc ceramic capacitor combination, as shown in Detail 4B.
- (✓) Connect this combination between lugs 6 (NS) and 7 (NS) of tube socket V1. Place this combination next to the one just installed.
- * (✓) R8. Connect a 22 K Ω (red-red-orange) resistor from lug 1 of terminal strip B (S-4) to lug 7 of tube socket V1 (NS).

- (✓) C8. Connect one lead of a 56 μf disc ceramic capacitor through lug 1 (NS) to lug 4 (NS) of wafer A. Now solder lug 1 (S-2). Connect the other lead to lug 2 of wafer A (NS). Be careful that these leads do not short to any metal parts of this switch.
- (✓) C15. Connect a 680 μf silver mica capacitor between lugs 1 (NS) and 2 (S-1) of wafer B.



Detail 5A

CHASSIS-TO-DIAL MECHANISM ASSEMBLY

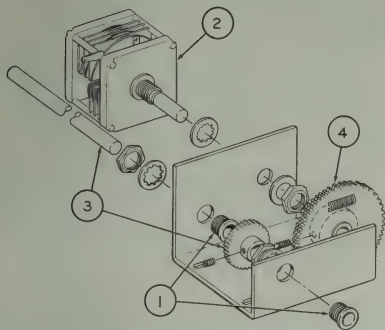
Refer to Pictorial 5 (fold-out from Page 21) for the following step.

- (✓) Mount the chassis to the dial mechanism, using three 6-32 x 1/4" screws, #6 lockwashers, and 6-32 nuts. The screws should be placed through the pointed bracket of the dial mechanism, then through the chassis, and fastened with lockwashers and nuts. See that the edges of the chassis line up with the sides of the dial mechanism. Do not tighten the screws yet.

Refer to Detail 5B for the following steps.

NOTE: When putting the variable capacitor assembly together, be careful to position each part as shown in Detail 5B. Be sure to keep the capacitor plates fully meshed, when possible, to avoid damage. The circled numbers in Detail 5B are keyed to the circled numbers in the following steps.

- (✓) Form a 1-1/4" length of #20 bare wire to fit around lugs 3, 5, 7, and 8 of wafer A. Solder this bare wire to lugs 3, 5, and 7, but do not solder to lug 8 yet. Note that lugs 4 and 6 are on the other side of the wafer and are not involved in this step.
- (✓) In a similar manner, form another 1-1/4" length of #20 bare wire and place this wire around lugs 3, 4, 5, and 6 of wafer B as shown in Detail 5A. Solder lugs 4, 5, and 6, but do not solder lug 3 yet.



Detail 5B

- 1 (✓) Install two shaft bushings on the variable capacitor bracket. Use control lockwashers and control nuts.
- 2 (✓) C1, C2. Mount the variable capacitor on the bracket with a control lockwasher, control flat washer, and control nut. Position the capacitor as shown.
- 3 (✓) Locate the 4-3/8" shaft and brass gear. Place the shaft through the first bushing, through the gear, and into the second bushing as shown. Start an 8-32 x 1/4" setscrew into the gear. Position the gear at the middle of the shaft and tighten the setscrew. This will prevent the shaft from falling out of the assembly. Final positioning of the gear and shaft will be taken care of later.
- 4 (✓) Start an 8-32 x 1/4" slotted head setscrew into the anti-backlash gear. Place this gear on the shaft of the

variable capacitor. Position the gear so the end of the shaft is flush with the outside surface of the gear; tighten the setscrew.

Refer to Pictorial 5 for the following steps.

- (✓) Mount the variable capacitor mechanism on the chassis, using four 6-32 x 1/4" screws, #6 lockwashers, and 6-32 nuts. Do not tighten yet.
- (✓) Loosen the setscrew in the brass gear, then slide the shaft forward into the shaft coupling extending from the dial mechanism. Tighten the setscrew of the shaft coupling onto the shaft. It may be necessary to loosen all the screws in the pointed mounting bracket and shift the dial mechanism to allow the shaft to line up and turn freely.
- (✓) Before meshing the gears in the next two steps, adjust the variable capacitor and the gear train to the proper position in the following manner: turn the tuning shaft coming from the front of the gear mounting plate to the fully counterclockwise position; turn the variable capacitor to the fully closed position.
- (✓) While holding one section of the anti-backlash gear, turn the other section one tooth so the teeth of the two sections line up; there will now be spring tension between the sections.
- (✓) Hold the anti-backlash gear as just directed and move the brass gear to mesh with the anti-backlash gear. Tighten the setscrew in the brass gear.
- (✓) Position the variable capacitor mechanism so there is no binding of the shaft running to the dial mechanism and then tighten the four screws holding the variable capacitor assembly to the chassis.

GENERAL WIRING

Refer to Pictorial 5 for the following steps.

(✓) RFC2. Connect the 1.1 millihenry RF choke from lug 5 of terminal strip B (S-2) to lug 6 of tube socket V1 (S-3). Place the body of the choke over terminal strip B.

* (✓) C27. Connect a 75 μ f disc ceramic capacitor between lug 2 (S-2) and lug 8 (S-2) of tube socket V1. Place the capacitor as shown.

(✓) Bend the small solder lug mounted on one screw at tube socket V2 to touch lug 7 of this socket and solder (S-1).

(✓) Bend the control solder lug near lug 1 of switch AA to touch this lug and solder (S-1).

(✓) Connect one end of a 5" hookup wire to lug 3 of terminal strip A (NS). Dress this wire toward the rear of the chassis, as shown, and leave the end free.

(✓) Connect a 7" hookup wire from lug 3 of terminal strip A (S-2) to lug 2 of switch AA (S-1).

(✓) Connect a 6-1/2" hookup wire from lug 1 of terminal strip A (NS) to lug 5 of switch AA (S-1).

(✓) Connect one end of a 13" hookup wire to lug 5 of terminal strip A (NS). Route this wire through grommet CC, then along the side of the dial mechanism, and over to the

pilot lamp sockets. Leave the end free temporarily.

(✓) Connect one end of a 15-1/2" hookup wire to lug 5 of tube socket V2 (S-1). Route this wire through grommet CC, across the subpanel, and back into the chassis area through grommet DD. Connect the end to lug 8 of terminal strip B (S-3).

(✓) Connect one end of a 14" hookup wire to lug 3 of switch AA (S-1). Route this wire through grommet CC, across the subpanel, and back into the chassis area through grommet DD. Connect the end to lug 10 of terminal strip B (S-4).

(✓) Connect one end of a 15" hookup wire to lug 4 of switch AA (S-1). Route this wire through grommet CC, across the subpanel, and back into the chassis area through grommet DD. Connect the other end to lug 11 of terminal strip B (S-2).

(✓) Connect one end of a 14-1/2" hookup wire to lug 4 of tube socket V1 (S-2). This end of the wire should be placed under the wires already running to the tube socket. Route the other end of this wire through grommet DD, then along the side of the dial mechanism, and over to the pilot lamp sockets. Leave the end free temporarily.

(✓) Check all of the long wires just installed to see that they are dressed neatly down against the chassis and subpanel. Be sure the wires are routed as shown in Pictorial 5.

(~~1~~) R11. Connect the 10 K Ω 10 watt resistor from lug 6 of terminal strip A (NS) to lug 1 of tube socket V2 (S-1). Position the resistor body close to the terminal strip.

(~~1~~) Cut each lead of the NE-2 neon lamp to 3/4". Connect one lead to lug 1 (S-2) and the other lead to lug 2 (NS) of terminal strip A.

(~~1~~) Connect the free end of the bare wire coming from lug 2 of trimmer D to lug 4 of wafer A (S-2). Remember that lugs 4 and 6 are on the rear of this wafer.

(~~1~~) Connect the free end of the bare wire coming from lug 2 of trimmer E to lug 6 of wafer A (S-1).

NOTE: Remember to use the heavy bare wire in the following steps. Form each length to reach the terminating points called out in the step before making the connections. Do not crimp the ends of the wires on the switch lugs. Connections should be made to the coil lugs by forming a small hook in the end of each wire.

(~~1~~) Connect a 3-1/2" heavy bare wire from lug 2 of coil K (S-2) to lug 2 of wafer A (S-2).

(~~1~~) Connect the free end of the bare wire coming from lug 1 of trimmer D to the heavy bare wire just installed (S-1).

(~~1~~) Connect a 3" heavy bare wire from lug 2 of coil L (S-2) to lug 8 of wafer A (S-2).

(~~1~~) Connect a 3-1/2" heavy bare wire from lug 1 of coil K (S-2) to lug 1 of wafer B (S-2).

(~~1~~) Connect a 3-1/2" heavy bare wire from lug 2 of the variable capacitor (NS) to lug 9 of wafer A (S-1).

(~~1~~) Connect a 2-1/4" heavy bare wire from lug 1 of the variable capacitor (S-1) to lug 10 of wafer A (S-1).

(~~1~~) Connect a 2-1/2" heavy bare wire from lug 1 of coil L (NS) to lug 3 of wafer B (S-2).

(~~1~~) Connect a 3-3/8" heavy bare wire from lug 1 of coil M (NS) to lug 7 of wafer B (S-1).

(~~1~~) Connect a 3" heavy bare wire from lug 7 of tube socket V1 (S-3) to lug 8 of wafer B (S-1).

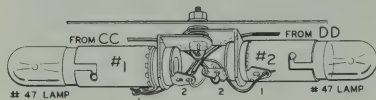
(~~1~~) Connect a 3-3/4" heavy bare wire from lug 2 of the variable capacitor (S-2) to lug 2 of coil M (S-2). Make sure this wire does not short to one of the trimmer connections or to the anti-backlash gear.

This completes all wiring steps that use the heavy bare wire.

PILOT LAMP WIRING

Refer to Detail 6A for the following steps.

- (F) Position the VFO so the pilot lamp sockets are accessible and bend the lugs of the sockets as shown.



Detail 6A

- (c) Connect a bare wire from lug 1 of the left socket (S-1) to the ground solder lug (NS).
- (d) Connect another bare wire from lug 1 of the right socket (S-1) to the ground solder lug (S-2).
- (e) Locate the two hookup wires; one coming from grommet CC and the other from grommet DD. Strip an additional 1/2" of insulation from one of these wires and connect the end through lug 2 of socket #1 (S-2) to lug 2 of socket #2 (NS).

- (✓) Connect the free end of the other hookup wire to lug 2 of socket #2 (S-2).
- (✓) Install a #47 lamp in each socket.

FINAL CHASSIS ASSEMBLY AND WIRING

Refer to Pictorial 6 for the following steps.

- (V) Position the chassis base against the bottom of the chassis and fasten it in place with nine 6-32 x 1/4" screws, #6 lockwashers, and 6-32 nuts. The screws should be placed through the chassis and chassis base, and then secured with lockwashers and nuts. Be very careful not to damage any of the components mounted on the chassis or to pinch the wires running along the edge of the chassis.

- (1) Fasten the sides of the chassis base to the edges of the subpanel. Use four 6-32 x 3/8" screws, #6 lockwashers, and 6-32 nuts.

- (7) Tighten the screws used to mount the dial mechanism to the chassis, checking to see that all shafts in the dial mechanism and tuning capacitor assembly turn freely.

- (4) Now solder lug 1 of coil L (S-2) and lug 1 of coil M (S-2).

- (4) Mount the four 1/2" shouldered spacers on the outside of the chassis base. Use a 6-32 x 3/8" screw and two #6 lockwashers for each spacer, one inside, and one outside the chassis.

- (✓) Mount 3-lug terminal strip EE inside the chassis base. Use a 6-32 x 1/4" screw, two #6 lockwashers, and a 6-32 nut.

- (✓) Mount phono socket FF with two 6-32 x 1/4" screws, #6 lockwashers, and 6-32 nuts. Orient this socket with its lugs as shown.

- (✓) Mount phone (key) jack GG with a control lockwasher, control flat washer, and control nut. Orient as shown.

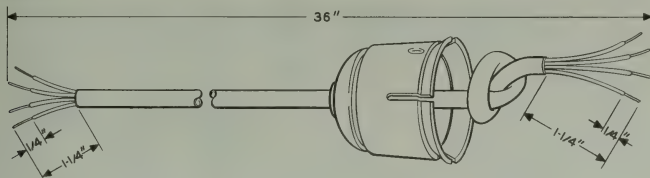
- (4) Connect the free end of the bare wire coming from lug 1 of tube socket V1 to lug 3 of terminal strip EE (NS).

- (✓) R 6. Connect a 10 K Ω (brown-black-orange) 1/2 watt resistor between lugs 1 (NS) and 2 (NS) of terminal strip EE.

- (✓) C31. Connect a .001 μ fd disc ceramic capacitor between Tugs 1 (NS) and 2 (S-2) of terminal strip EE.

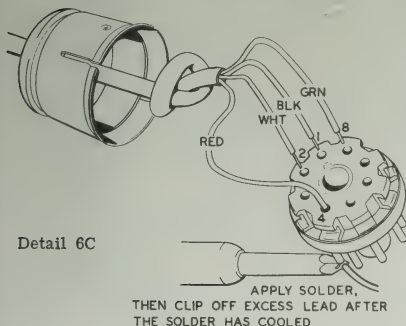
- (✓) R5. Connect a 2200 Ω (red-red-red) 1/2 watt resistor between lugs 1 (S-3) and 3 (NS) of terminal strip EE.

- (\hookrightarrow) C30, Connect a 100 $\mu\mu\text{f}$ mica capacitor from lug 3 of terminal strip EE (S-3) to lug 1 of phono socket FF (S-1).



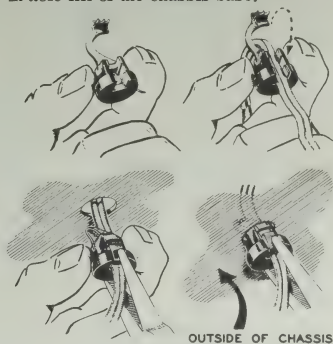
Detail 6B

- (✓) Connect a short bare wire between lugs 2 (S-1) and 3 (S-1) of jack GG.
- (✓) Connect the free end of the hookup wire coming from lug 3 of terminal strip A to lug 1 of jack GG (S-1).
- () Prepare each end of the 3-foot length of 4-conductor cable as shown in Detail 6B.
- () Attach the octal plug and plug cap to one end of this cable as shown in Detail 6C.
- (✓) Connect the white wire to lug 5 of terminal strip A (S-2).
- (✓) Connect the black wire to lug 4 of terminal strip A (S-1).
- (✓) Connect the green wire to lug 2 of terminal strip A (S-2).
- (✓) Referring to Detail 6D, install the plastic strain relief around the 4-conductor cable in hole HH of the chassis base.



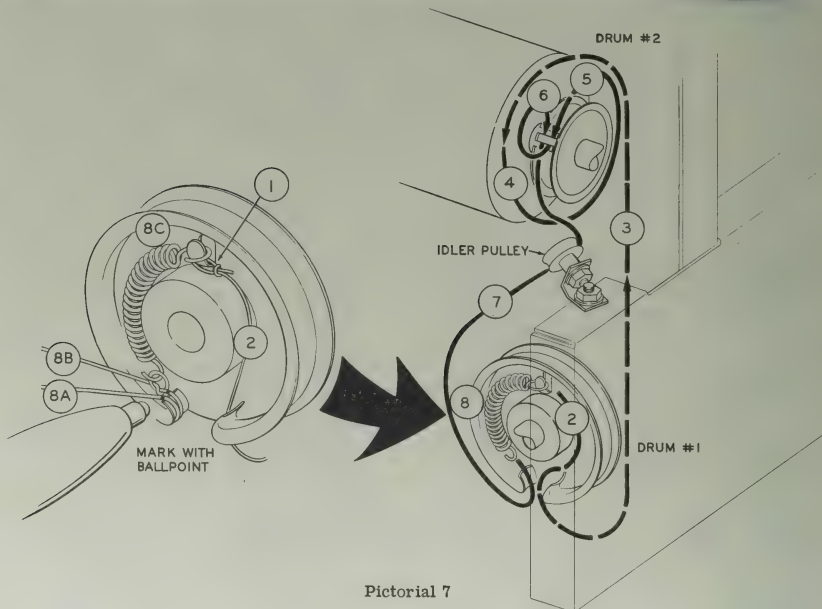
Detail 6C

- () Snap the plug cap over the plug, making sure the cap seats firmly.
- () Insert the other end of this cable through hole HH of the chassis base.
- (✓) Connect the red wire to lug 6 of terminal strip A (S-2).



Detail 6D

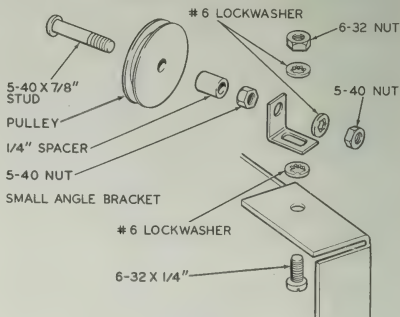
This completes the wiring of the VFO. Check to see that all connections are soldered securely and that there are no short circuits caused by wire clippings, solder splashes, or improper lead dress. In particular, check the heavy bare wires running to switch BB. All hookup wires should be dressed against the chassis.

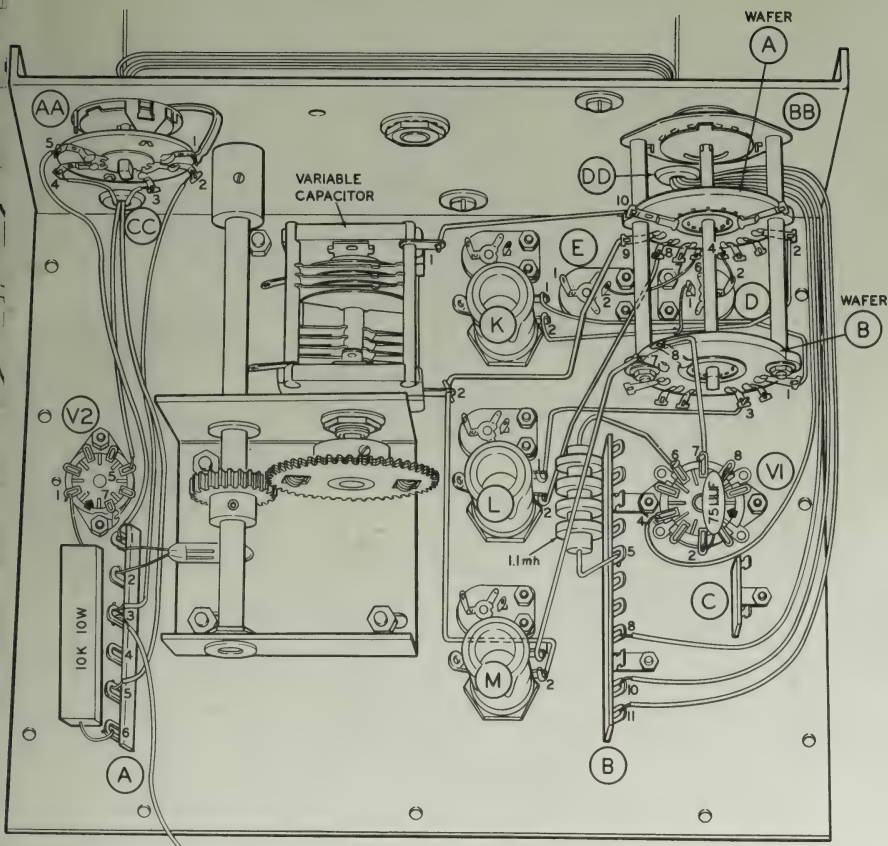


DIAL DRIVE ASSEMBLY

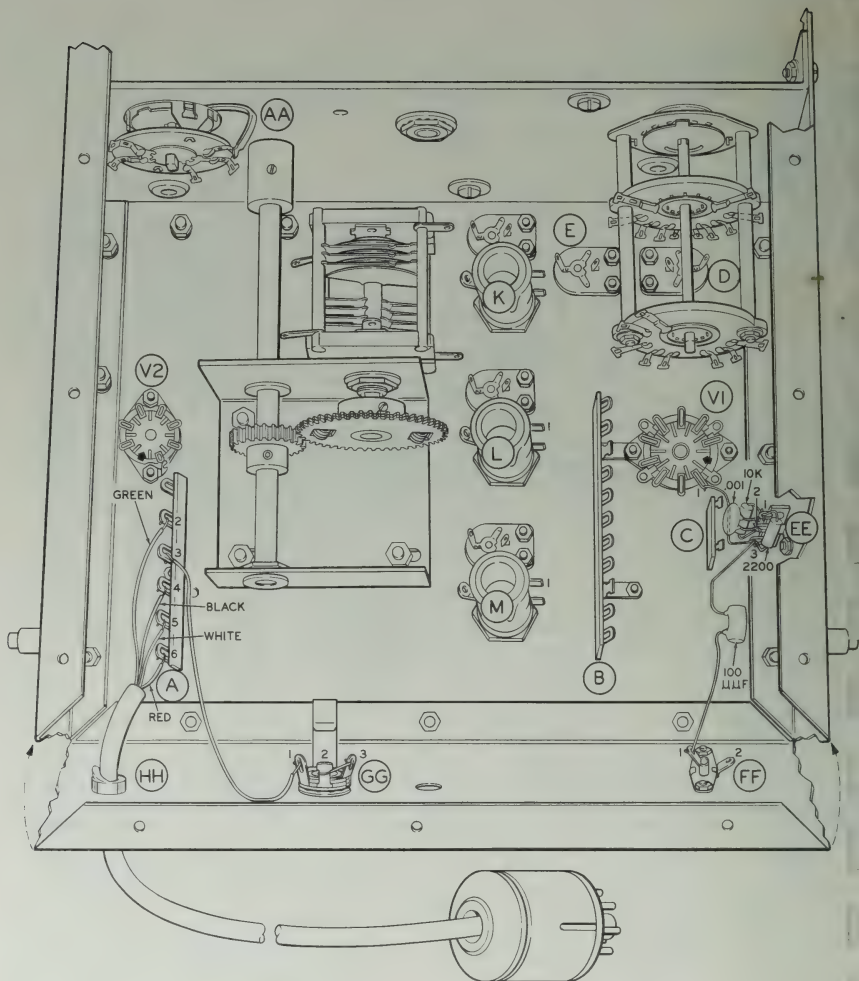
Refer to Detail 7A for the following steps.

- (✓) Mount the idler pulley and the 1/4" spacer on the 5-40 x 7/8" stud as shown. Next, tighten a 5-40 nut as far as it will go onto the stud.
- (✓) Mount the stud, with the idler pulley, on the small angle bracket as shown, and fasten it with a #6 lockwasher and a 5-40 nut.
- (✓) Mount the angle bracket on the upper flange of the chassis base in the position shown in Pictorial 7. Use a 6-32 x 1/4" screw, two #6 lockwashers, and a 6-32 nut as shown in Detail 7A.

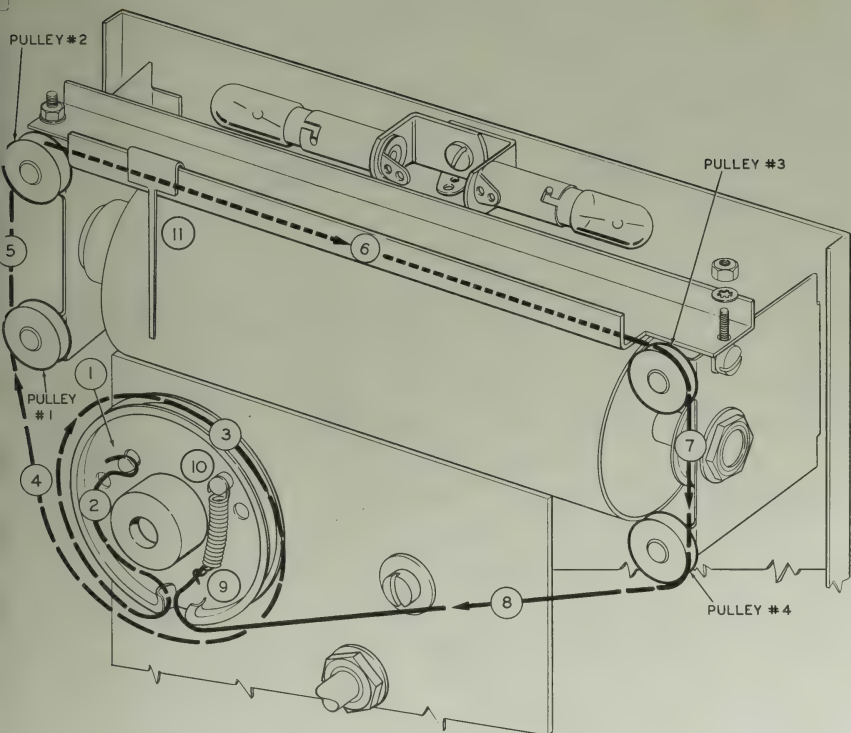




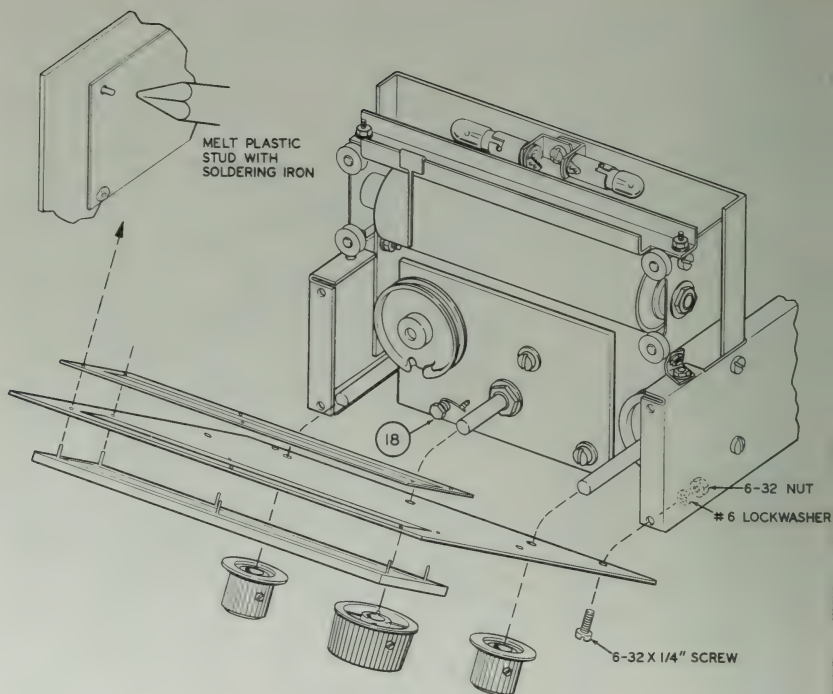
Pictorial 5



Pictorial 6



Pictorial 8



Pictorial 9

- (1) Bend the angle bracket by pushing upward until the pulley is tilted upward, as it appears in Pictorial 7.

Refer to the proper circled number in Pictorial 7 for each of the following steps.

- 1 () Turn the BAND switch shaft counterclockwise so the dial cord drum is in the position shown in Pictorial 7. Cut a 19" length of dial cord and tie a loop in one end of it. Fasten this loop around the tab in dial cord drum #1.
- 2 () Route the other end of the cord out through the opening in the dial cord drum, and up behind drum #2.
- 3 () Route the dial cord completely around drum #2.
- 5 () Turn drum #2 so that the slot faces toward you, as it is shown. Insert the dial cord through the rear opening in the slot first and wrap it around the tab as shown.
- 6 () Route the dial cord down behind the idler pulley and around the side of dial cord drum #1 to the opening.
- 7 () Hold the dial cord so the string is tight as shown in 8A, and make a mark on the string with a ballpoint pen about 1/8" from the opening.
- 8A () Tie the dial cord spring to the dial cord at the point just beyond the mark made by the ballpoint pen.
- 8B () Stretch the spring out and connect the other end to the tab of dial cord drum #1.

Refer to Pictorial 8 for the following steps.

- () Mount the dial pointer bracket on the spade bolts of the dial drum supports with #6 lockwashers and 6-32 nuts. It may be necessary to loosen the dial drum support mounting screws for this step. If so, be sure to re-

tighten them when the step is completed, then make sure that the dial cylinder still rotates freely.

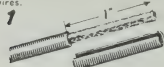
- 1 () With the shaft of the FREQUENCY control turned to the fully counterclockwise position, adjust the large dial cord drum to the position shown in Pictorial 8 by loosening and then retightening the setscrew. Tie a loop in one end of the remaining length of dial cord and fasten the loop around the correct tab of the large dial cord drum.
- 2 () Route the dial cord out through the opening, and one complete turn around the outside of the drum.
- 3 () Route the dial cord around pulley #1 and pulley #2, and across the top of the dial pointer bracket.
- 4 () Route the dial cord around pulleys #3 and #4, and back through the opening of the large dial cord drum.
- 5 () Hold the dial cord so the string is tight and make a mark with a ballpoint pen on the string about 1/4" inside the drum opening. Refer back to 8A on Pictorial 7.
- 6 () Tie the dial cord spring to the dial cord at the point just beyond the mark made by the ballpoint pen. Stretch the opening and connect the other end of it to the tab.
- 7 () Mount the dial pointer on the dial pointer bracket. Place the dial cord between the tabs on the pointer. Press the tabs together loosely so that the pointer will stay connected to the cord, but so that its position can be easily adjusted to the correct location later. Make sure the pointer does not rub on the dial cylinder.

FINAL ASSEMBLY

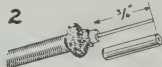
Refer to Pictorial 9 for the following steps.

- () Install the dial window on the lettered side of the front panel by inserting the six plastic studs through the small holes around the dial window opening.
- () Place the dial plate (#205-M315F) over the plastic studs on the back side of the front panel with the painted side toward the front panel. Fasten the dial window and dial plate to the front panel by melting down the six plastic studs as shown.
- () Fasten the front panel to the chassis assembly with 6-32 x 1/4" screws, #6 lock-washers, and 6-32 nuts in the four mounting holes.
- () Install the large knob on the shaft of the FREQUENCY control.
- () Install small knobs on the shafts of the FUNCTION switch and BAND switch.
- () Prepare the length of RG-62/U coax cable by installing a phono plug on each end as shown in Detail 9A. Set this prepared cable aside until it is called for in the Installation section of the manual.

Remove 1" of outer insulation. It may be necessary to slit the insulation lengthwise to remove. Take care not to cut shield wires.



Push the shield back as far as it will go and strip off 3/4" of insulation from the inner conductor.



Place phono connector on cable firmly against inner insulation. Solder inner conductor.



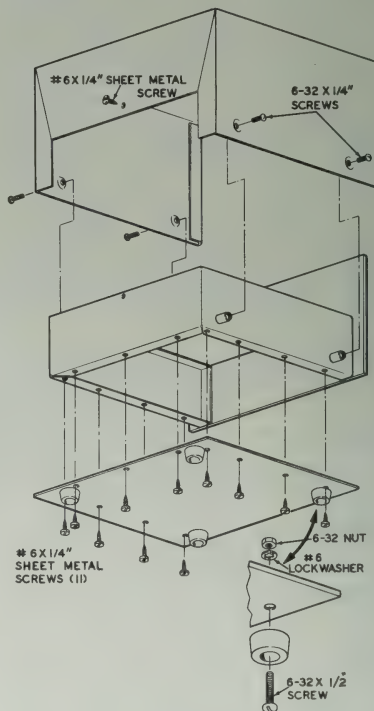
Dress shield up on base of connector and solder. Then trim inner conductor from tip.



Detail 9A

Refer to Pictorial 10 for the following step.

- () Mount the four rubber feet to the bottom plate. Use 6-32 x 1/2" screws, #6 lock-washers, and 6-32 nuts as shown in the Detail of Pictorial 10. Be sure to use the correct hole at each corner of the bottom plate.



Pictorial 10

Set the bottom plate aside temporarily. The bottom plate, cabinet, and tubes will be installed later.

INSTALLATION

This part of the manual is divided into the following three sections to cover the different types of VFO installations:

1. Use with the "HEATHKIT DX-60" Transmitter.
2. Use with the "HEATHKIT DX-40" Transmitter.
3. Use with "Other Transmitters," having suitable VFO input and VFO operating voltage provisions or, having a VFO input but no provisions for furnishing operating voltages to the VFO.

Use only the section which applies to your particular installation of the VFO.

HEATHKIT DX-60

Since the VFO was designed for use with the DX-60 Transmitter, just connect the octal plug of the VFO power cable to the accessory socket of the DX-60, and connect the prepared coax cable from the VFO output socket to the VFO input of the DX-60. Be sure to turn the DX-60 XTAL switch to VFO and turn the DRIVE LEVEL control to "0" while checking VFO calibration.

Now proceed to the VFO Calibration section of the manual.

HEATHKIT DX-40

It is necessary to make three simple circuit changes in the VFO in order to use it with the DX-40 Transmitter. Make these changes as follows:

- () Locate the resistor connected to lug 4 of the accessory socket in the DX-40. Replace this resistor with a 10 K Ω 10 watt resistor, obtained locally.
- () Disconnect the green wire of the power cable from lug 2 of terminal strip A, then reconnect this wire to lug 3 of terminal strip A. See Figure 1.
- () Clip out the bare wire connected between lugs 2 and 3 of the KEY jack. See Figure 1.

The VFO is now ready for use with the DX-40 Transmitter. Connect the octal plug of the VFO power cable to the accessory socket of the DX-40. Connect the prepared coax cable from the VFO output socket to the VFO input of the DX-40.

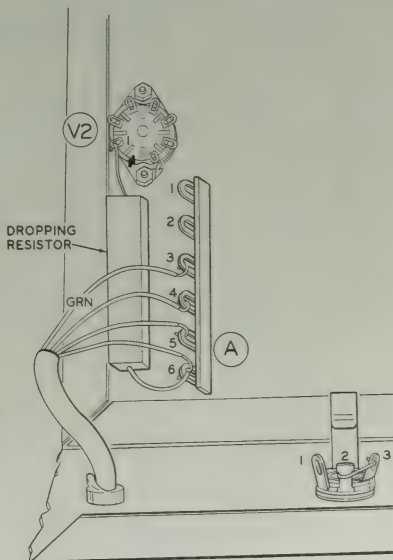


Figure 1

Proceed to VFO Calibration section of the manual.

OTHER TRANSMITTERS

Depending on your particular transmitter, it may be necessary to make one or more circuit changes in the VFO. These possible circuit changes concern "Keying" and "Supply Voltage." Each of the items should be handled separately, as follows:

KEYING

If your transmitter provides a grid block keying signal (-65 volts or more) it will not be necessary to change the VFO keying circuit. The grid block keying signal is applied to the VFO through the green wire of the power cable, which is connected to pin 4 of the octal plug.

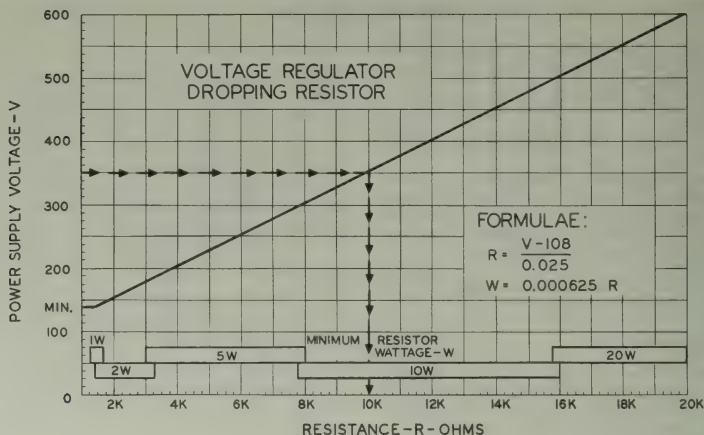


Figure 2

For cathode keying of the VFO, it is necessary to make the following changes in the VFO.

- () Referring to Figure 1, disconnect the green wire of the power cable from lug 2 of terminal strip A, then reconnect this wire to lug 3 of terminal strip A.
- () Clip out the bare wire connected between lugs 2 and 3 of the KEY jack if the key is to be plugged into the transmitter.

The VFO is now ready for cathode keying. The key may be connected to the VFO KEY jack or to the transmitter. If the key is connected to the transmitter, the keying connection to the VFO is made through pin 8 and the green wire of the VFO power cable.

SUPPLY VOLTAGE

The value of the B+ voltage applied to the voltage regulator tube in the VFO is critical. For this reason, the value of the Dropping Resistor in series with the VR tube must be chosen to provide the correct voltage. The chart in Figure 2 should be used to determine the correct resistance and wattage of the Dropping Resistor. For example: If the B+ available from the transmitter is 350 volts, draw a line from the

350 volt point on the vertical scale across to the diagonal line of the graph. Then draw a line down from the point of intersection, to the horizontal scale. The point that this line crosses the horizontal scale indicates the resistance value and wattage for the Dropping Resistor. This example is shown by the line of arrows on Figure 2. Do not use smaller resistance or wattage values. The correct Dropping Resistor should be installed in the VFO as shown in Figure 1. The 10 K Ω , 10 watt resistor, already in the VFO, should be removed. Figure 3 shows the VR tube and Dropping Resistor circuit schematically.

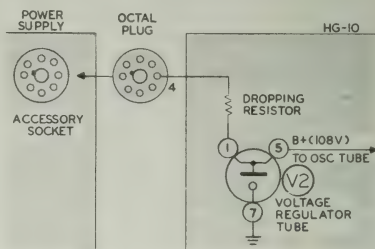


Figure 3

Filament voltage of 6.3 volts AC should be applied to the VFO through pin 2 of the octal plug and the white wire of the power cable. Pin 1 and the black wire are used for the ground connection between the VFO and the transmitter.

If your transmitter cannot be used to supply operating voltages to the VFO, you may choose to build a separate power supply for the VFO.

The circuit of a suitable power supply is shown in Figure 4. Parts for the power supply should be obtained locally. If a separate power supply is used, be sure to use the correct value of dropping resistor in the VFO, depending on the B+ voltage available from the power supply. The octal plug from the VFO can be connected to the power supply, but separate keying and ground connections will be needed between the power supply and the transmitter.

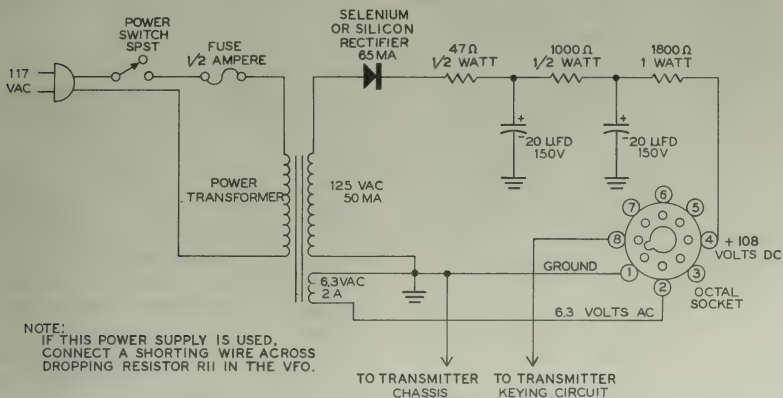


Figure 4

VFO CALIBRATION

DIAL INDICATOR

- () Loosen the 6-32 screw that is used as a setscrew in the bushing of the dial cylinder. Next, set the BAND switch to the 80 meter position, then position the dial cylinder so that the 80 meter scale is centered, looking through the dial window from the front of the VFO. Tighten the setscrew in the dial indicator bushing.
- () Rotate the BAND switch through its positions. In each position, the corresponding dial scale should be centered, looking through the dial window. If the scales are not centered in the dial window opening, repeat the preceding step.

DIAL POINTER

- () With the BAND switch in the 80 meter position, rotate the FREQUENCY knob clockwise until you feel the mechanism reach the upper mechanical stop.
- () Position the dial pointer 1/16" to the right of 4.0 on the scale, then secure the pointer on the dial cord by bending the fingers of the pointer. Be careful not to cut the dial cord.
- () Rotate the FREQUENCY knob counter-clockwise and see that the dial pointer travels smoothly.

VARIABLE CAPACITOR

- () Loosen the setscrew in the small brass gear of the variable capacitor assembly. Refer to Figure 5.

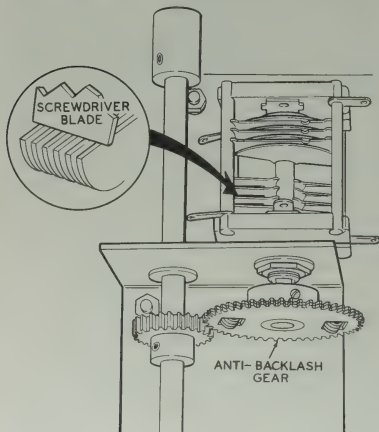


Figure 5

- () Rotate the FREQUENCY knob counter-clockwise until you feel the mechanism reach the lower mechanical stop. NOTE: This stop is spring loaded and the shaft will slip if the FREQUENCY knob is turned farther.
- () While holding the FREQUENCY knob at the lower mechanical limit, turn the anti-backlash gear by hand until the plates of the variable capacitor are meshed. The plates are properly meshed when the edges are flush at the point shown in Figure 5. The end of a screwdriver blade can be used to check for proper mesh at this point. Retighten the setscrew in the small brass gear.
- () The VFO bottom plate should be installed now, using eleven #6 x 1/4" sheet metal screws. See Pictorial 10 on Page 26.

PRESET ADJUSTMENTS

Refer to Figure 6 for the following steps.

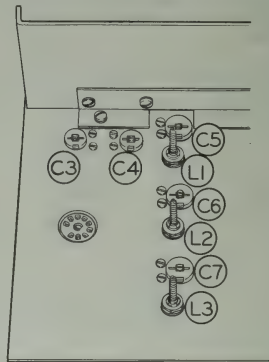


Figure 6

- () Set each trimmer capacitor (C3 through C7) so that the slot is parallel to the front panel.
- () Preset each coil as follows, measuring from the tip of the coil adjustment screw to the point where the screw leaves the coil mounting bushing.

COIL

DIMENSION

L1	1"
L2	7/8"
L3	7/8"

TRIMMER COIL ADJUSTMENTS

To calibrate the VFO, it will be necessary to use an accurate radio receiver that covers 3.5 to 9 megacycles. For best results, use a crystal calibrator with the receiver to assure setting the receiver dial to the exact frequencies called for. The VFO adjustments should be made with an insulated alignment tool.

Before proceeding with calibration, install the two tubes in the VFO: V1 = 6CH8, V2 = 6B2.

After the tubes are installed, take care not to damage the tubes by setting the VFO upside down. Connect the power cable of the VFO to your transmitter as directed in the Installation section of the manual; then turn on both units and allow the VFO to warm up for at least thirty minutes. The coax cable need not be connected between the VFO and transmitter during calibration.

When making the following adjustments, the VFO should be placed next to the receiver so the receiver will pick up the signal radiated from the VFO.

NOTE: The trimmer capacitors may drift slightly for several minutes after they are adjusted, therefore, go through the calibration slowly.

Refer to Figure 6 for the following steps.

80 METERS

- () Turn the FUNCTION switch to the SPOT position and the BAND switch to the 80 meter position. Set the VFO dial pointer to 3.5.
- () Tune in the VFO signal near 3.5 mc on the receiver. Then adjust coil L3 to bring the signal to exactly 3.5 mc.
- () Set the VFO dial to 4 and tune in this signal with the receiver. If the signal is not exactly at 4 mc, proceed as follows:

1. If the signal is lower than 4 mc, set the VFO dial a few kc above the bottom of the band (try 3510) and turn the receiver to 3.5 mc. Adjust coil L3 for zero beat in the receiver. Next, set the VFO dial to 3.5 and adjust trimmer C7 for zero beat. Check the VFO against the receiver at 4 mc. Repeat this procedure as necessary until the VFO provides a 4 mc signal with the dial set at 4 and a 3.5 mc signal with the dial set at 3.5.
2. If the signal was higher than 4 mc, set the VFO dial to 3.5 and turn the receiver a few kc above the bottom of the band (try 3510). Adjust coil L3 for zero beat in the receiver. Turn the receiver to 3.5 mc and adjust trimmer C7 for zero beat. Check the VFO against the receiver at 4 mc. Repeat this procedure until the VFO

provides a 4 mc signal with the dial set at 4 and a 3.5 mc signal with the dial set at 3.5.

40-20-15-10 METERS

- () Leave the FUNCTION switch in the SPOT position and turn the BAND switch to the 40 meter position. Set the VFO dial pointer to 7.
 - () Tune in the VFO signal near 7 mc on the receiver, then adjust coil L2 to bring the signal to exactly 7 mc.
 - () Set the VFO dial to 7.3 and tune in the signal with your receiver. If the signal is not exactly at 7.3 mc, proceed as follows:
1. If the signal was lower than 7.3 mc, set the VFO dial a few kc above the bottom of the band (try 7010) and turn the receiver to 7 mc. Adjust coil L2 for zero beat in the receiver. Next, set the VFO dial to 7 and adjust trimmer C6 for zero beat. Check the VFO against the receiver at 7.3 mc. Repeat this procedure as necessary until the VFO provides a 7.3 mc signal with the dial set at 7.3 and a 7 mc signal with the dial set at 7.
 2. If the signal was higher than 7.3 mc, set the VFO dial to 7 and turn the receiver a few kc above the bottom of the band (try 7010). Adjust coil L2 for zero beat in the receiver. Turn the receiver to 7 mc and adjust trimmer C6 for zero beat. Check the VFO against the receiver at 7.3 mc. Repeat the procedure until the VFO provides a 7.3 mc signal with the dial set at 7.3 and a 7 mc signal with the dial set at 7.

The above adjustments cover the 20, 15, and 10 meter bands as well as the 40 meter band since all of these bands use multiples of the 7 mc band signals.

6 METERS

- Leave the FUNCTION switch in the SPOT position and set the BAND switch to the 6 meter position. Set the VFO dial pointer to 50.4.
- () Tune in the VFO signal near 8.4 mc on the receiver, then adjust coil L1 to bring the signal to exactly 8.4 mc as tuned on the receiver.

() Set the VFO dial to 54 and tune in this signal near 9 mc with your receiver. If the signal is not exactly at 9 mc, proceed as follows:

1. If the signal was lower than 9 mc, set the VFO dial a few kc above 50.4 and turn the receiver to 8.4 mc. Adjust coil L1 for zero beat in the receiver. Next, set the VFO dial to 50.4 and adjust trimmer C5 for zero beat. Check the VFO setting at 54 against the receiver at 9 mc. Repeat this procedure as necessary until the VFO provides a 9 mc signal with the dial set at 54 and an 8.4 mc signal with the dial set at 50.4.
2. If the signal was higher than 9 mc, set the VFO dial to 50.4 and turn the receiver a few kc above 8.4 mc. Adjust coil L1 for zero beat in the receiver. Turn the receiver to 8.4 mc and adjust trimmer C5 for zero beat. Check the VFO setting at 54 against the receiver at 9 mc. Repeat this procedure until the VFO provides a 9 mc signal with the dial set at 54 and an 8.4 mc signal with the dial set at 50.4.

NOTE: If an 8.33 to 9 mc receiver is not available, a 6 meter receiver can be used, aligning at 50 and 54 mc.

2 METERS

- () Leave the FUNCTION switch in the SPOT position and set the BAND switch to the 2 meter position. Set the VFO dial pointer to 144.
- () Tune in the VFO signal near 8 mc on the receiver. Adjust trimmer C3 until the signal is exactly 8 mc. Then set the VFO dial to 147.6 and tune in this signal near 8.2 mc on the receiver. Adjust trimmer C4 for a signal at exactly 8.2 mc.
- () Repeat the above two adjustments until an output signal of 8 mc is obtained with the VFO dial set at 144 and a signal of 8.2 mc is obtained with the VFO dial set at 147.6.

NOTE: A 2 meter receiver can be used if an 8-8.222 receiver is not available, using 144 and 148 mc as alignment points.

- () Recheck the 6 and 2 meter calibration for accuracy.

This completes the calibration of your VFO. Install the cabinet with the screws shown in Pictorial 10 on Page 26.

NOTE: It will be noted that bands 40, 20, 15, and 10 do not have their calibrations in exact alignment with each other. This is due to the slight changes in lead length in the band switch between bands, and causes no harm.

OPERATION

By means of the FUNCTION switch, the VFO may be controlled independently of the transmitter or controlled by the transmitter. With the key up, the VFO should be operated alone for tuning purposes by turning to SPOT. It is bad operating procedure to tune a VFO across the band with the entire transmitter following it. This causes needless interference to other stations. The VFO alone should be set to the desired frequency. Then quickly tune the transmitter to resonance at the frequency. This procedure produces far less interference.

Crowding the band edges is not recommended unless a positive and constant check upon frequency is maintained, particularly with a phone transmitter where the sidebands may run three or more kc over and under the base frequency.

Even a single sideband transmitter can put some hash on the undesired sideband and create signals outside of the amateur band.

Refer to the operating directions for your transmitter which concern use of the transmitter with a VFO.

NOTE: The VFO may be keyed any time by using a key in its key jack, provided proper voltages are supplied to it. This feature is useful for testing keyers or for code practice, and for use with transmitters which will work when just the VFO input is keyed.

NOTE: The DX-60 function switch must be in the TUNE position when using the VFO in SPOT in order to supply B+ voltage to the VFO.

IN CASE OF DIFFICULTY

CAUTION: Do not set the VFO upside down without the cabinet installed, as the only support would be the tubes which could be damaged.

1. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as it is checked. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something consistently overlooked by the constructor.
2. It is interesting to note that about 90% of the kits that are returned for repair, do not function properly due to poor connections and soldering. Therefore, many troubles can be eliminated by reheating all connections to make sure that they are soldered as described in the Proper Soldering Techniques section of this manual.
3. Check to be sure that all tubes are in their proper locations. Make sure that all tubes light up properly.
4. Check the tubes with a tube tester or by

substitution of tubes of the same types and known to be good.

5. Check the values of the component parts. Be sure that the proper part has been wired into the circuit, as shown in the pictorial diagrams and as called out in the wiring instructions.
6. Check for bits of solder, wire ends or other foreign matter which may be lodged in the wiring beneath the chassis.
7. If, after careful checks, the trouble is still not located and a voltmeter is available, check voltage readings against those found on the Schematic Diagram. **NOTE:** All voltage readings were taken with an 11 megohm input vacuum tube voltmeter. Voltages may vary as much as 10% due to line voltage variations.
8. A review of the Circuit Description will prove helpful in indicating where to look for trouble.

TROUBLESHOOTING CHART

TROUBLE	POSSIBLE CAUSE
No Output	<ol style="list-style-type: none"> 1. Faulty tube. 2. Open key in KEY jack. 3. RF output cable open or shorted.
Low Output	<ol style="list-style-type: none"> 1. Low B+ voltage. 2. RF output cable too long. 3. Transmitter VFO input impedance too low.
Instability	<ol style="list-style-type: none"> 1. Low B+ voltage, below 108 V DC. 2. VR tube faulty. 3. Key contacts dirty (for cathode keying only).
Oscillator continues to run with key up (grid block keying only).	<ol style="list-style-type: none"> 1. Transmitter is not furnishing negative grid block keying voltage to VFO; should be -65 V DC or more - enough to light the neon bulb. 2. Green wire of power cable open.

SERVICE INFORMATION

SERVICE

If, after applying the information contained in this manual and your best efforts, you are still unable to obtain proper performance, it is suggested that you take advantage of the technical facilities which the Heath Company makes available to its customers.

The Technical Consultation Department is maintained for your benefit. This service is available to you at no charge. Its primary purpose is to provide assistance for those who encounter difficulty in the construction, operation or maintenance of HEATHKIT equipment. It is not intended, and is not equipped to function as a general source of technical information involving kit modifications nor anything other than the normal and specified performance of HEATHKIT equipment.

Although the Technical Consultants are familiar with all details of this kit, the effectiveness of their advice will depend entirely upon the amount and the accuracy of the information furnished by you. In a sense, **YOU MUST QUALIFY** for GOOD technical advice by helping the consultants to help you. Please use this outline:

1. Before writing, fully investigate each of the hints and suggestions listed in this manual under **In Case Of Difficulty**. Possibly it will not be necessary to write.
2. When writing, clearly describe the nature of the trouble and mention all associated equipment. Specifically report operating procedures, switch positions, connections to other units and anything else that might help to isolate the cause of trouble.
3. Report fully on the results obtained when testing the unit initially and when following the suggestions under **In Case Of Difficulty**. Be as specific as possible and include voltage readings if test equipment is available.
4. Identify the kit model number and date of purchase, if available. Also mention the date of the kit assembly manual. (Date at bottom of Page 1.)
5. Print or type your name and address, preferably in two places on the letter.

With the preceding information, the consultant will know exactly what kit you have, what you would like it to do for you and the difficulty you wish to correct. The date of purchase tells him whether or not engineering changes have been made since it was shipped to you. He will know what you have done in an effort to locate the cause of trouble and, thereby, avoid repetitious suggestions. In short, he will devote full time to the problem at hand, and through his familiarity with the kit, plus your accurate report, he will be able to give you a complete and helpful answer. If replacement parts are required, they will be shipped to you, subject to the terms of the Warranty.

The Factory Service facilities are also available to you, in case you are not familiar enough with electronics to provide our consultants with sufficient information on which to base a diagnosis of your difficulty, or in the event that you prefer to have the difficulty corrected in this manner. You may return the completed instrument to the Heath Company for inspection and necessary repairs and adjustments. You will be charged a minimal service fee, plus the price of any additional parts or material required. However, if the completed kit is returned within the Warranty period, parts charges will be governed by the terms of the Warranty. State the date of purchase, if possible.

Local Service by Authorized HEATHKIT Service Centers is also available in some areas and often will be your fastest, most efficient method of obtaining service for your HEATHKIT equipment. Although you may find charges for local service somewhat higher than for factory service, the amount of increase is usually offset by the transportation charge you would pay if you elected to return your kit to the Heath Company.

HEATHKIT Service Centers will honor the regular 90 day HEATHKIT Parts Warranty on all kits, whether purchased through a dealer or directly from Heath Company; however, it will be necessary that you verify the purchase date of your kit.

Under the conditions specified in the Warranty, replacement parts are supplied without charge; however, if the Service Center assists you in

locating a defective part (or parts) in your kit, or installs a replacement part for you, you may be charged for this service.

HEATHKIT equipment purchased locally and returned to Heath Company for service must be accompanied by your copy of the dated sales receipt from your authorized HEATHKIT dealer in order to be eligible for parts replacement under the terms of the Warranty.

THIS SERVICE POLICY APPLIES ONLY TO COMPLETED EQUIPMENT CONSTRUCTED IN ACCORDANCE WITH THE INSTRUCTIONS AS STATED IN THE MANUAL. Equipment that has been modified in design will not be accepted for repair. If there is evidence of acid core solder or paste fluxes, the equipment will be returned NOT repaired.

For information regarding modification of HEATHKIT equipment for special applications, it is suggested that you refer to any one or more of the many publications that are available on all phases of electronics. They can be obtained at or through your local library, as well as at most electronic equipment stores. Although the Heath Company sincerely welcomes all comments and suggestions, it would be impossible to design, test, evaluate and assume responsibility for proposed circuit changes for special purposes. Therefore, such modifications must be made at the discretion of the kit builder, using information available from sources other than the Heath Company.

REPLACEMENTS

Material supplied with HEATHKIT products has been carefully selected to meet design requirements and ordinarily will fulfill its function without difficulty. Occasionally improper instrument operation can be traced to a faulty component. Should inspection reveal the necessity for replacement, write to the Heath Company and supply all of the following information.

- A. Thoroughly identify the part in question by using the part number and description found in the manual Parts List.
- B. Identify the type and model number of kit in which it is used.
- C. Mention date of purchase.

- D. Describe the nature of defect or reason for requesting replacement.

The Heath Company will promptly supply the necessary replacement. **PLEASE DO NOT RETURN THE ORIGINAL COMPONENT UNTIL SPECIFICALLY REQUESTED TO DO SO.** Do not dismantle the component in question as this will void the guarantee. This replacement policy does not cover the free replacement of parts that may have been broken or damaged through carelessness on the part of the kit builder.

SHIPPING INSTRUCTIONS

In the event that your instrument must be returned for service, these instructions should be carefully followed.

Be sure to return the completed kit with the tubes in place and the top and bottom covers installed.

Attach a letter to the carton with your name, address, date of purchase, model and type of transmitter used, and a brief description of the trouble.

ATTACH A TAG TO THE EQUIPMENT BEARING YOUR NAME, COMPLETE ADDRESS, DATE OF PURCHASE, AND A BRIEF DESCRIPTION OF THE DIFFICULTY ENCOUNTERED. Wrap the equipment in heavy paper, exercising care to prevent damage. Place the wrapped equipment in a stout carton of such size that at least three inches of shredded paper, excelsior, or other resilient packing material can be placed between all sides of the wrapped equipment and the carton. Close and seal the carton with gummed paper tape, or alternately, tie securely with stout cord. Clearly print the address on the carton as follows:

To: HEATH COMPANY
Benton Harbor, Michigan

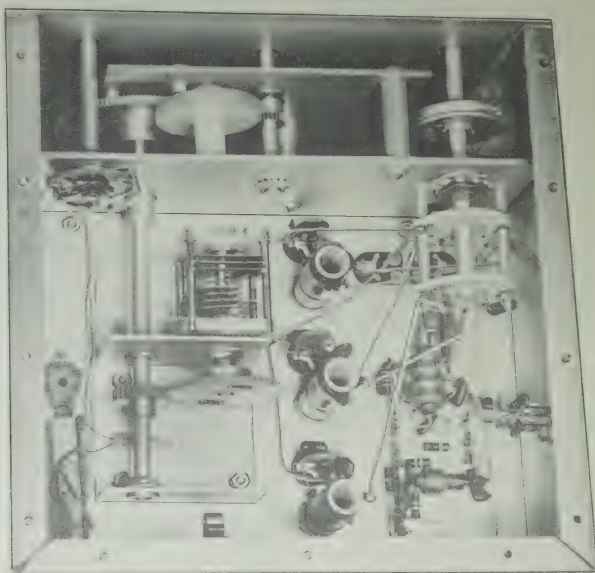
Include your name and return address on the outside of the carton. Preferably affix one or more "Fragile" or "Handle With Care" labels to the carton, or otherwise so mark with a crayon of bright color. Ship by insured parcel post or prepaid express; note that a carrier cannot be held responsible for damage in transit if, in HIS OPINION, the article is inadequately packed for shipment.

WARRANTY

Heath Company warrants that for a period of three months from the date of shipment, all Heathkit parts shall be free of defects in materials and workmanship under normal use and service and that in fulfillment of any breach of such warranty, Heath Company shall replace such defective parts upon the return of the same to its factory. The foregoing warranty shall apply only to the original buyer, and is and shall be in lieu of all other warranties, whether express or implied and of all other obligations or liabilities on the part of Heath Company and in no event shall Heath Company be liable for any anticipated profits, consequential damages, loss of time or other losses incurred by the buyer in connection with the purchase, assembly or operation of Heathkits or components thereof. No replacement shall be made of parts damaged by the buyer in the course of handling or assembling Heathkit equipment.

NOTE: The foregoing warranty is completely void and we will not replace, repair or service instruments or parts thereof in which acid core solder or paste fluxes have been used.

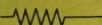
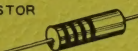

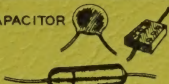


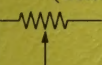











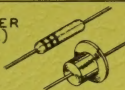

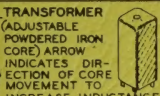





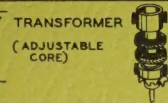











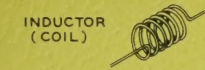









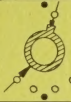


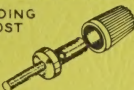











HEATH COMPANY



TYPICAL COMPONENT TYPES


This chart is a guide to commonly used types of electronic components. The symbols and related illustrations

should prove helpful in identifying most parts and reading the schematic diagrams.

RESISTOR  	CAPACITOR  	 TUBE PLATE SUPPRESSOR SCREEN GRID CATHODE FILAMENT 
POTENTIOMETER (CONTROL)  	ELECTROLYTIC CAPACITOR  	PNP TRANSISTOR  NPN TRANSISTOR  TRANSISTOR COLLECTOR BASE EMITTER 
 TRANSFORMER (IRON CORE) 	 VARIABLE CAPACITOR 	 RECTIFIER (DIODE) 
 TRANSFORMER (ADJUSTABLE POWDERED IRON CORE) ARROW INDICATES DIRECTION OF CORE MOVEMENT TO INCREASE INDUCTANCE 	 BATTERY 	 NEON BULB 
 TRANSFORMER (ADJUSTABLE CORE) 	 PHONO JACK 	 ILLUMINATING BULB 
 POWER TRANSFORMER 	 PHONE JACK 	 METER 
 INDUCTOR (COIL) 	 RECEPTACLE 	 SPST SWITCH (TOGGLE)  DPDT 
 PIEZOELECTRIC CRYSTAL 	 SPEAKER 	 SWITCH (ROTARY) 
 BINDING POST 	 MICROPHONE 	 FUSE 
 GENERAL ANTENNA  LOOP	 EARTH GROUND  CHASSIS GROUND	CONDUCTORS  NOT CONNECTED  CONNECTED  SHIELDED

HEATH COMPANY

BENTON HARBOR, MICHIGAN

 *a subsidiary of*
DAYSTROM, INCORPORATED

THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM

